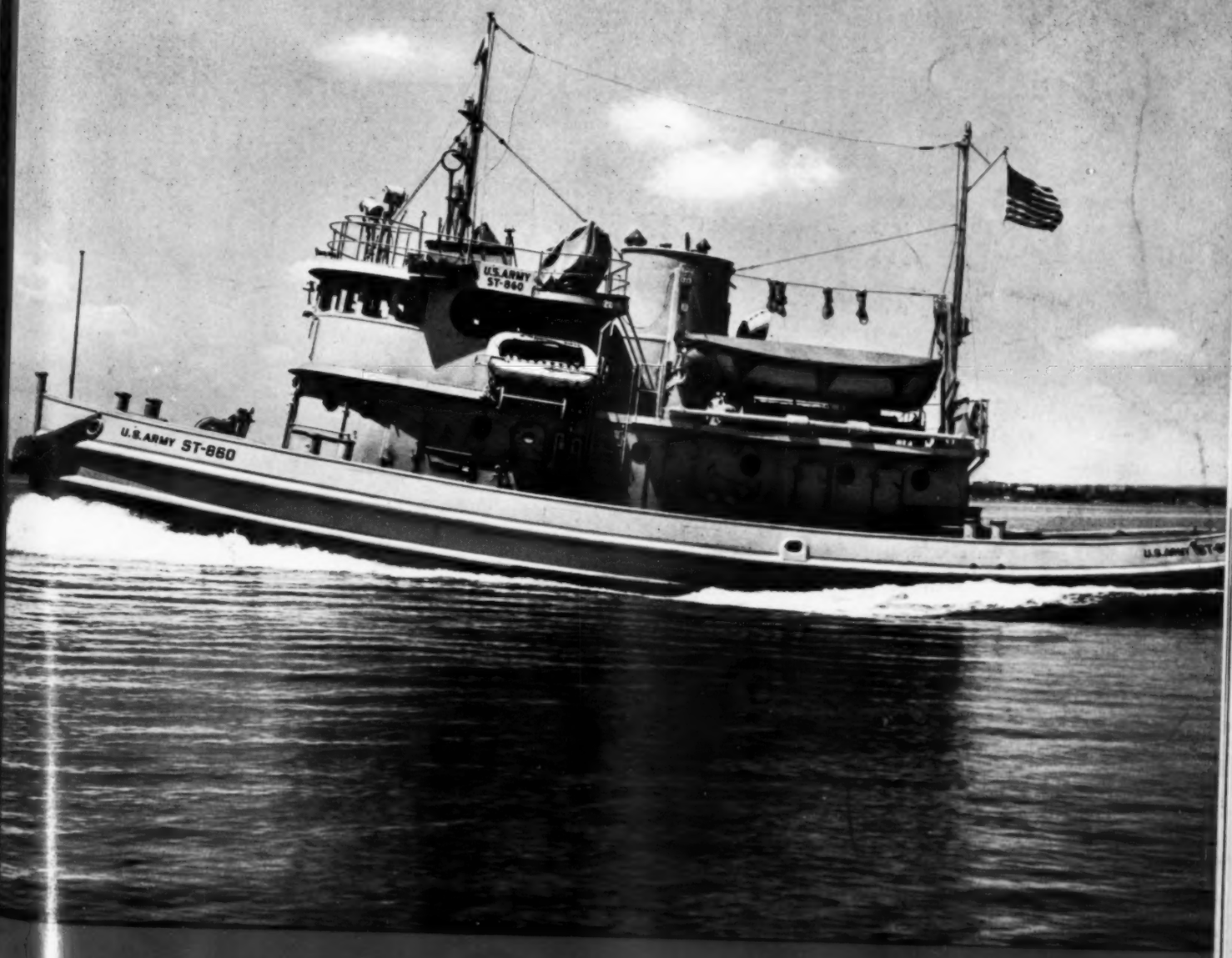
DIESEL PROGRESS



SEPTEMBER, 1945

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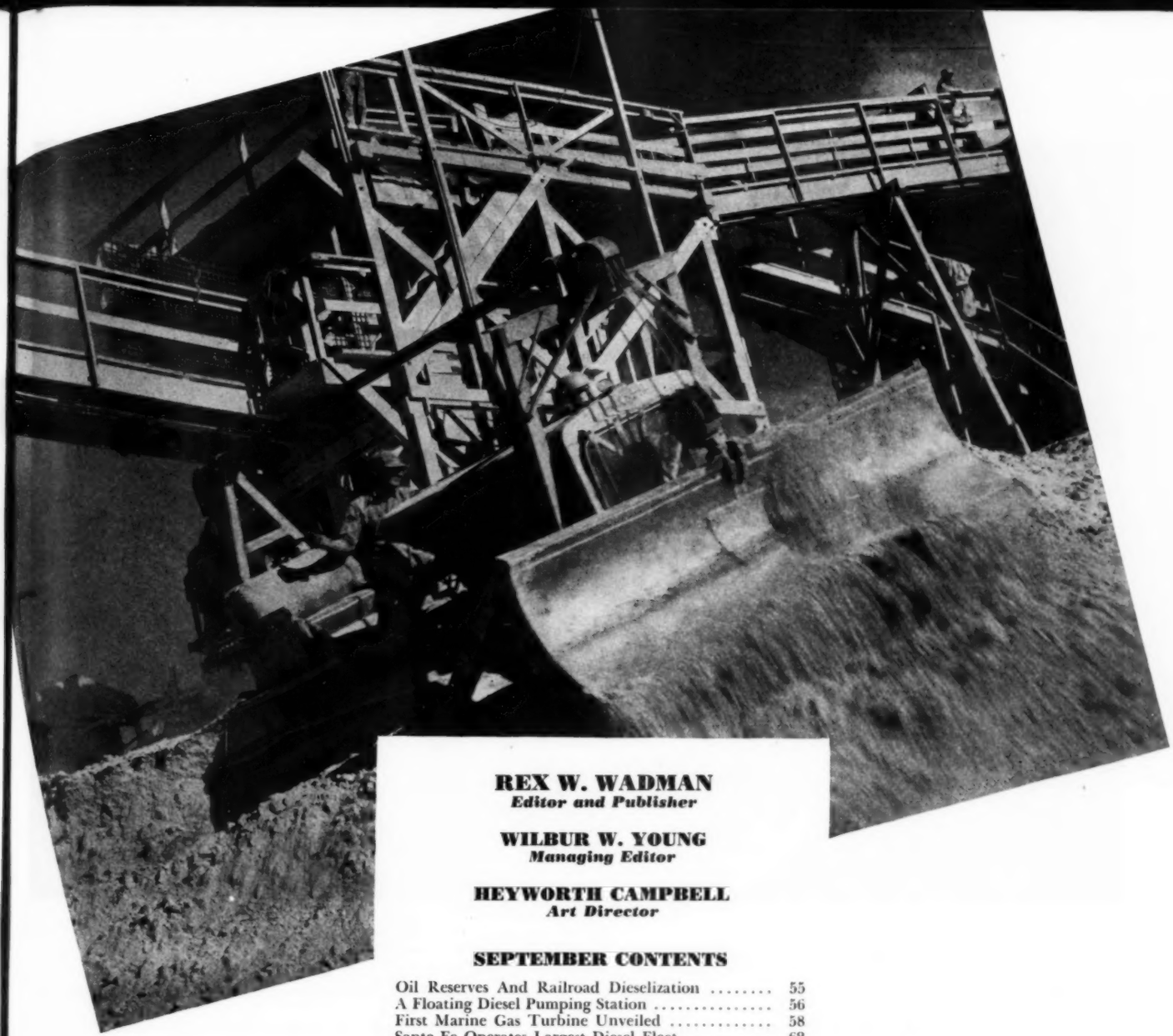

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DIESEL and GAS ENGINE PROGRESS

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OIL RESERVES AND RAILROAD DIESELIZATION

By R. TOM SAWYER

Editor's Note: R. Tom Sawyer, engineer, Diesel equipment, American Locomotive Company, is widely and most favorably known among DIESEL PROGRESS Readers. His words, both spoken and written, carry authority. We are pleased to reproduce herewith the script of Mr. Sawyer's talk before a recent Empire State Town Meeting under the general topic, "Coal and Oil For Transportation," conducted under the auspices of Union College and the Schenectady Forum Service and broadcast by station WGY.

WHEN we talk about oil and transportation one of the most important questions is the extent of our oil resources. If we are going to run short of oil in the near future perhaps we shouldn't be using it to run locomotives since we have plenty of coal, but ought to save it for making gasoline to power our planes and automobiles.

We often see figures showing that our proved oil reserves in the United States are estimated at 20 billion barrels. Our annual production is about a billion 400 million barrels. By simple arithmetic it looks as though we had oil enough to last for only 14 years. The arithmetic is correct enough but it doesn't give a true picture. We have plenty of oil.

For one thing, estimates of proved reserves are always much less than the actual potential of the proven fields. As these fields are further developed and extended they will probably yield 30 billion barrels. More important is the fact that less than half of the territory in the United States has been explored which is known to be geologically favorable for the existence of oil. Past experience and conservative estimates, therefore, show that our oil resources are more nearly 70 billion barrels.

This estimate, however, is based on the inefficient recovery methods used in the past. When we revise the figures in terms of modern methods of oil production we arrive at a minimum figure of 100 billion barrels for the United States alone. Furthermore, geologists believe that another 100 billion barrels of oil exists in North America outside of the United States. That adds up to 2000 billion barrels—plenty of oil.

However, long before our reserves of natural crude are exhausted, we will be converting

R. Tom Sawyer

natural gas and coal into oil. The processes are known and have only to be applied on a large scale in this country as has already been done in Europe. As Mr. Partington has pointed out, we have coal enough to last 3000 years, and we have vast reserves of natural gas. In addition, great deposits of shale and tar sands are another potential source of petroleum. So —we don't have to worry about having enough liquid fuel.

As with coal, there are great variations in the quality of crude oil. It varies in appearance from water—white to a heavy tarry stuff that congeals in air. Some crudes have a paraffin, or wax base, and others have an asphalt base. Some are high in sulphur content, some contain a lot of gasoline and others a high percentage of fuel oil.

These differences, however, are not important today. In modern refineries crude oil of any kind can be transformed by chemical processes into all types of petroleum products in any desired proportion. No matter what you start with, the important thing is that you start with a mixture of hydrocarbons—complex molecules of hydrogen and carbon—which can be broken up and put together again in any desired combination to form any desired volume of gasolines, fuel oils, lubricants and other products with an infinite variety of quality and uses.

The heat content both of crude oil and various fuels made from it, is in the range of 18,000 to 20,000 Btu's per pound as compared to the average of 12,000 to 13,000 Btu's for bituminous coal.

In normal times, the bulk of the nation's output of petroleum products is distributed by pipelines, tankers, barges and trucks. Railroads were called upon before the war, to handle only from 5 to 7 per cent of the output. During the war, however, this proportion rose to some 17 per cent, with the railroads doing a magnificent job in the face of interrupted tanker movements. However, even this is only a small part of the industry's output compared to the railroad's job of hauling over 80% of all the coal produced in this country.

Oil products, in peacetime, represent only 4½% of rail freight traffic as compared to coal which accounts for one third of the freight. On the other hand, the consumption of petroleum fuels by the railroads is increasing, due in part to the growing use of Diesel-electric locomotives. In 1942 the railroads bought over 160,000,000 barrels of fuel oil. This was about 12% of the total output of the petroleum industry, as compared to the railroads' consumption of some 20% of the annual coal production.

About the same amount of fuel oil was sold for home heating purposes. Smelters, mines and manufacturing industries, accounted for over 210 million barrels. Ships took a total of 126 million barrels and more than the 85 million barrels went to power plants. In that year 40% of total crude oil production was converted into gasoline for cars and planes. Petroleum products are also being made in large volume for use in synthetic rubber and synthetic toluene, a basic ingredient of TNT.

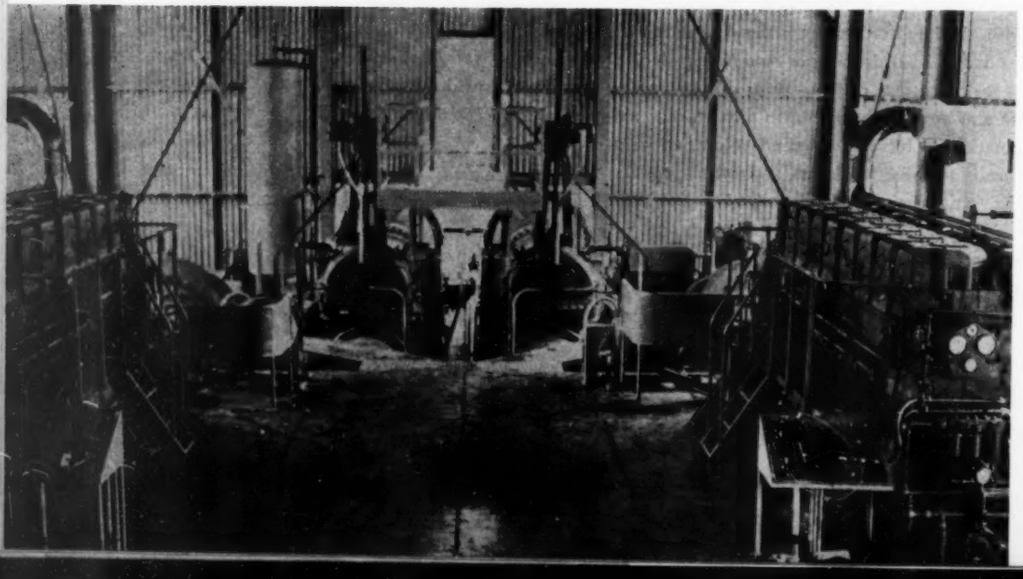
Railroads use two kinds of fuel oil. Distillates, which are light oils, are used to operate Diesel locomotives. Residual oils, which are heavy oils, are used instead of coal in 6700 oil-burning steam locomotives.

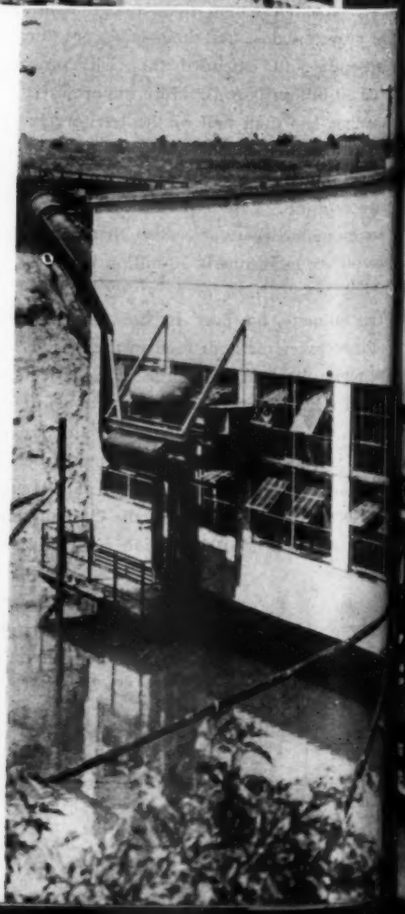
In some areas, railroads find it cheaper to burn oil instead of coal in their steam locomotives, and will sometimes convert a coal-burning engine to oil or vice versa as the prices of the two fuels vary.

. . . . *And now please turn to page 84* . . . .

Above: Two 36-inch discharge lines merge into a 60-inch line. Ball and socket joints allow for raising and lowering of barge. Below: The two Cooper-Bessemer Diesels and pumps can lift 100 million gallons of water a day.

Right: A floating pumping station with capacity to supply a city of 400,000 people. Diesel cooling coils, foreground; exhaust silencer left.





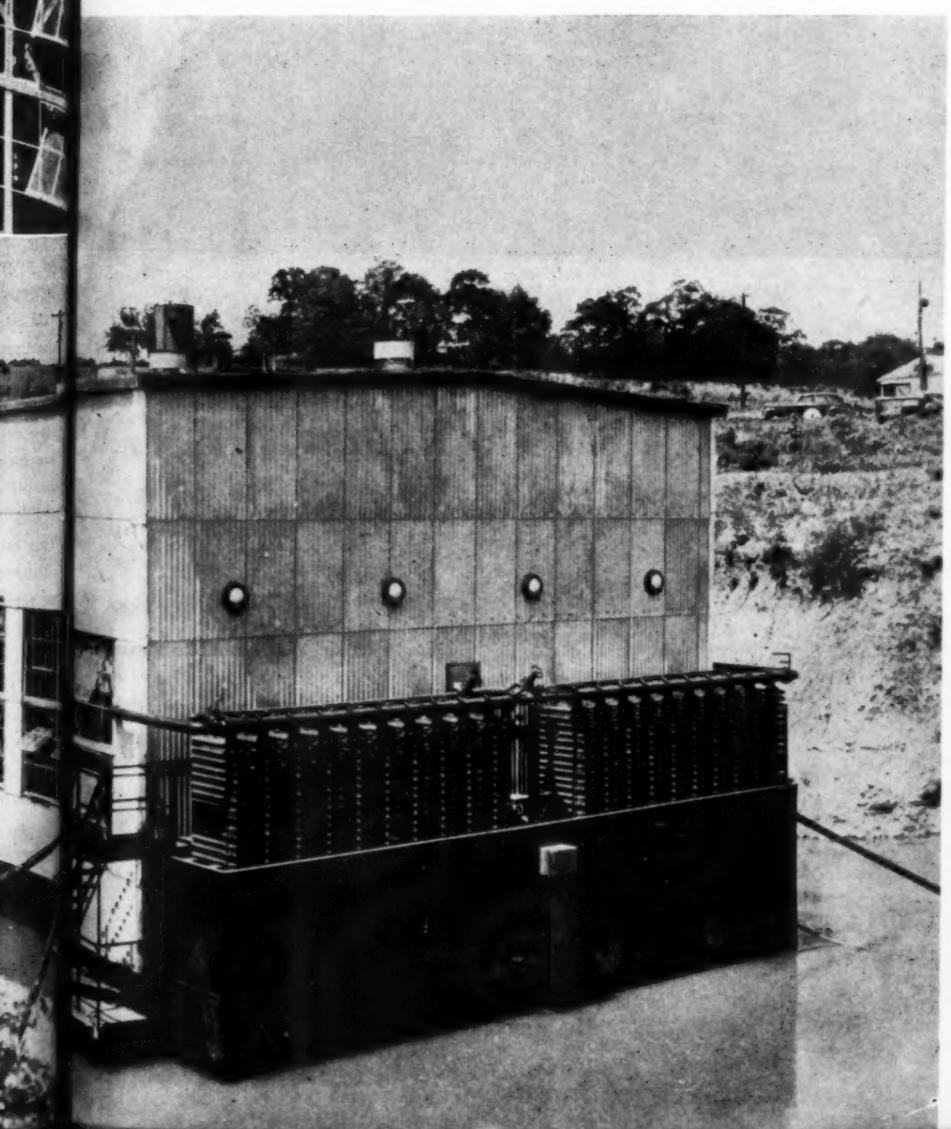
FLOATING DIESEL PUMPING STATION

By DWIGHT ROBINSON

A PUMPING station large enough to supply water to a city of 400,000 people was taken to the water when engineering studies showed a conventional land-located station could not be built to protect one of the nation's war-vital oil fields from flooding. The plan for saving the Cumberland field, second largest oil reserve in Oklahoma, tells how the largest pumping plant of its kind in the world is successfully coping with rainfall and seepage in a 12½ mile water shed in the southern part of the state. When the plans of the Federal Government for the Denison Dam flood control project in the Red River basin below the confluence with the Washita River practically coincided with The Pure Oil Company's strike in Marshall County in 1940 producing 2,410 barrels of oil in 14¾ hours, the Government agreed to divert the flow of the Washita River around the field. This was a change from the original plans made before the discovery of oil and which called for flooding the area in which the Cumberland field is located.

Construction of a levee to divert the river's flow was started in June 1943 and required a year for completion. It was a large and costly undertaking by the Government. It then was up to The Pure Oil Company to provide facilities for removing rain water and seepage in the 12½ mile watershed within the levee—no small job either.

Inability to get war-critical materials for a land-located station and other considerations caused Pure Oil engineers to decide on a direct connection between engines and pumps by mounting on a barge 85 feet long, 45 feet wide, 5-foot draft and a 25-foot high building to house the equipment.



The floating water plant, now completed and in operation, consists of two 30 by 38-inch centrifugal pumps direct connected to Cooper-Bessemer vertical Diesel engines, with a rated horsepower of 600 at 400 revolutions per minute. Belted to the main drive shaft of each of these two Diesel engines is a 900 revolutions per minute, 100 kva., 3 phase, 440/220 volt generator which supplies electric current to the switchboard for operating the auxiliaries.

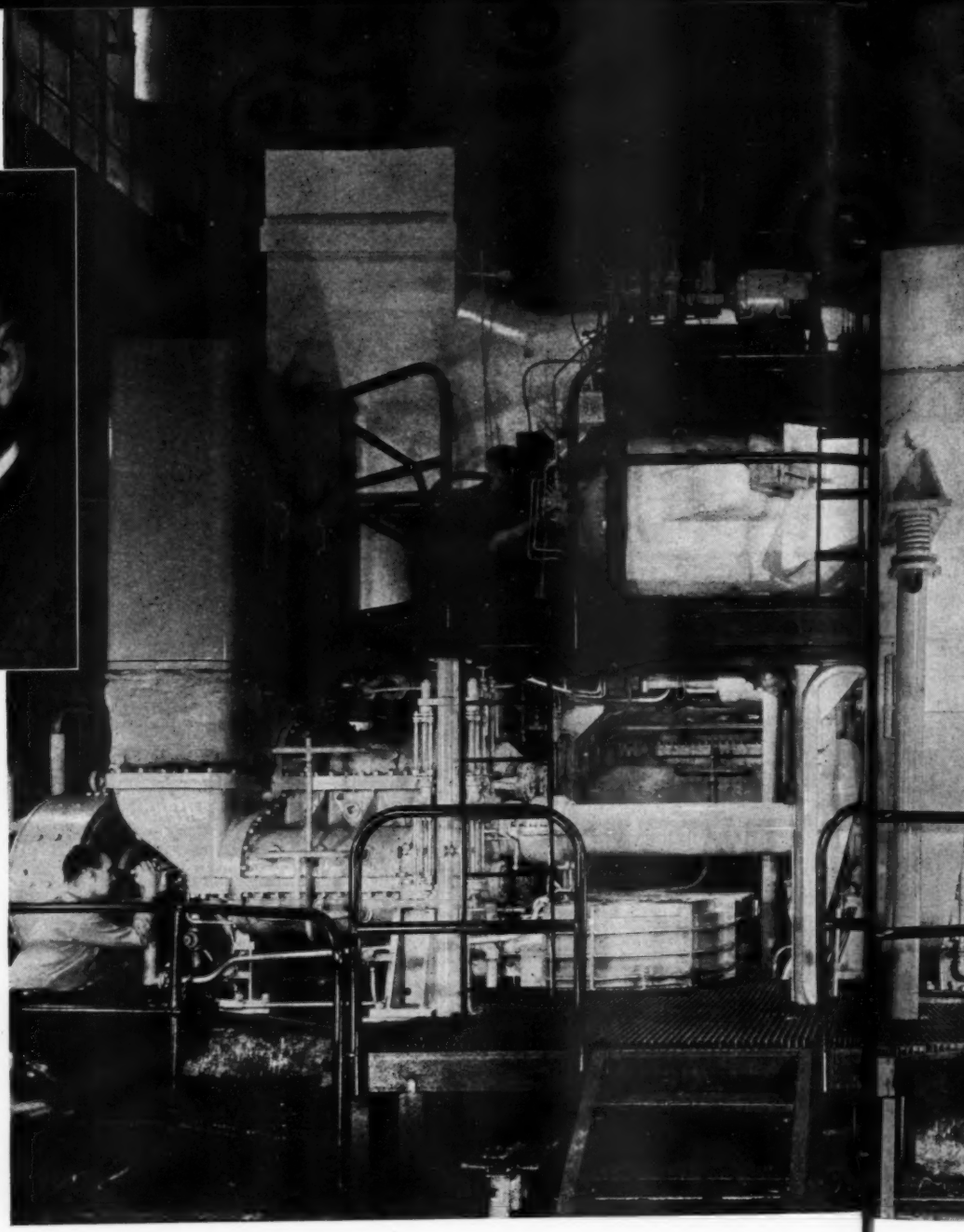
Closed cooling coils at the end of the barge cool the Diesels. Circulation is accomplished by two 6-inch centrifugal pumps powered by 30-horsepower electric motors. Spray water is furnished to the coils and also is circulated through a heat exchanger for lubricating oil cooling by two 5-inch centrifugal pumps powered by 15-horsepower electric motors. The barge also carries other electric motors and gasoline engines—for powering vacuum pumps to prime main pumps, for powering air compressors for starting, for standby service and for other purposes. Fuel oil supply is on land and flows to barge through flexible hose connections.

The daily maximum capacity of two Cooper-Bessemer powered pumps is over 100,000,000 gallons. The Diesels have a combined capacity of 45,000 gallons a minute at maximum head. The two 36-inch discharge lines from the barge also support a walk-way to permit access from land. Ball and socket type joints, possibly the largest ever built, provide articulation for the discharge lines at each end of an 80-foot span. The ball joints are 60 inches in diameter, have a 2-inch thick wall and weigh 8000 pounds. The two discharge lines merge into one 60-inch line by the means of a Y member made of reinforced steel plate weighing approximately 6 tons which, with the ball joints, is mounted in a thrust frame. The 60-inch line leads into a stilling basin and the final discharge to the reservoir is through a 10-foot wide by 5-foot high concrete spillway.

The basin for the barge was made by excavating approximately 30,000 yards of earth from the side of a natural hill. Concrete piers capped with 14 by 16-inch wood beams provided a 5-foot high barge cradle in the basin, which is 100 by 50 feet in size. The barge was erected directly upon the cradle. This unusual water pumping plant recently was put into service and today is playing its part in assuring uninterrupted oil production from the Cumberland field.

Ronald B. Smith, Elliott engineering vice president.

Professor C. R. Soderberg, (M.I.T.) and consulting engineer for Elliott Company.



The first, successfully completed, gas turbine for ship propulsion is seen here undergoing tests in the Elliott shops. Complete maneuvering of this 2500 hp. unit is achieved through the control panel and one operator, extreme right.

ELLIOTT UNVEILS FIRST MARINE GA RB

By WILBUR W. YOUNG

ELLIOTT Company has successfully completed the only gas turbine ever built for marine propulsion and has heralded it as the first power gas turbine for continuous, long-time service to be built in the United States. Having been under test for a period sufficiently long to have established its performance characteristics this machine is envisoned as the possible forerunner of a line of similar prime power units in somewhat prescribed fields. We shall try, within the limits of this article, to give readers of DIESEL PROGRESS an overall picture of the new Elliott gas turbine and of the builder's vision of its future applications.

Exposed to public view for the first time late in July, after many months of close collaboration between Navy and Elliott engineers this gas turbine was revealed in a running condition, capable of maneuvering throughout its entire speed and power range under the finger-tip control of a single operator. Its maximum output at the take-off shaft is 2500 hp., operating at 1200° F., with an overall thermal efficiency of 29% and a fuel rate of 0.47 lb. burning Diesel distillate. There are the guide characteristics among which it is interesting to note that its operating efficiency has missed design efficiency by only 3.5%—it being claimed that this difference is capable of being over-

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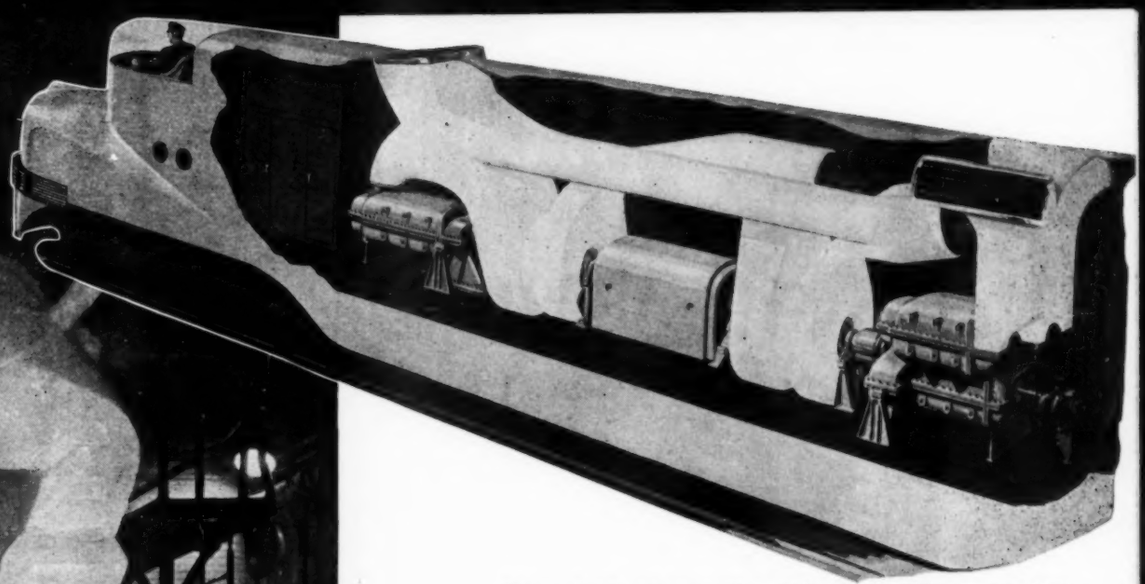
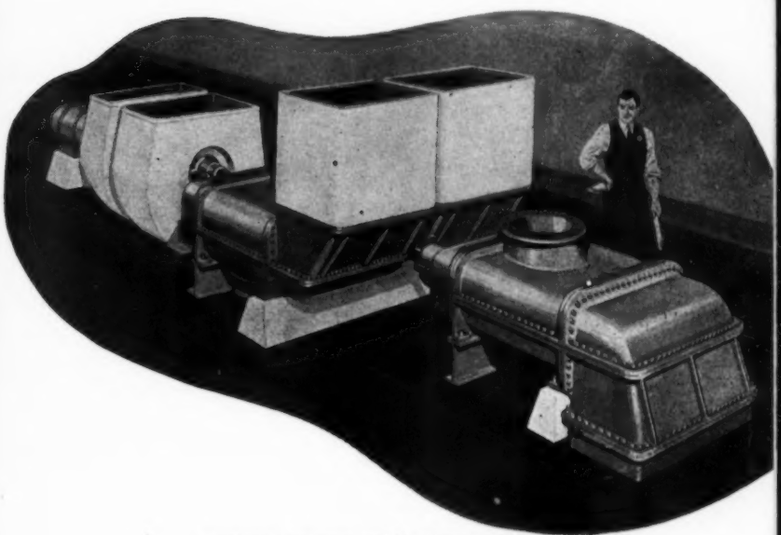
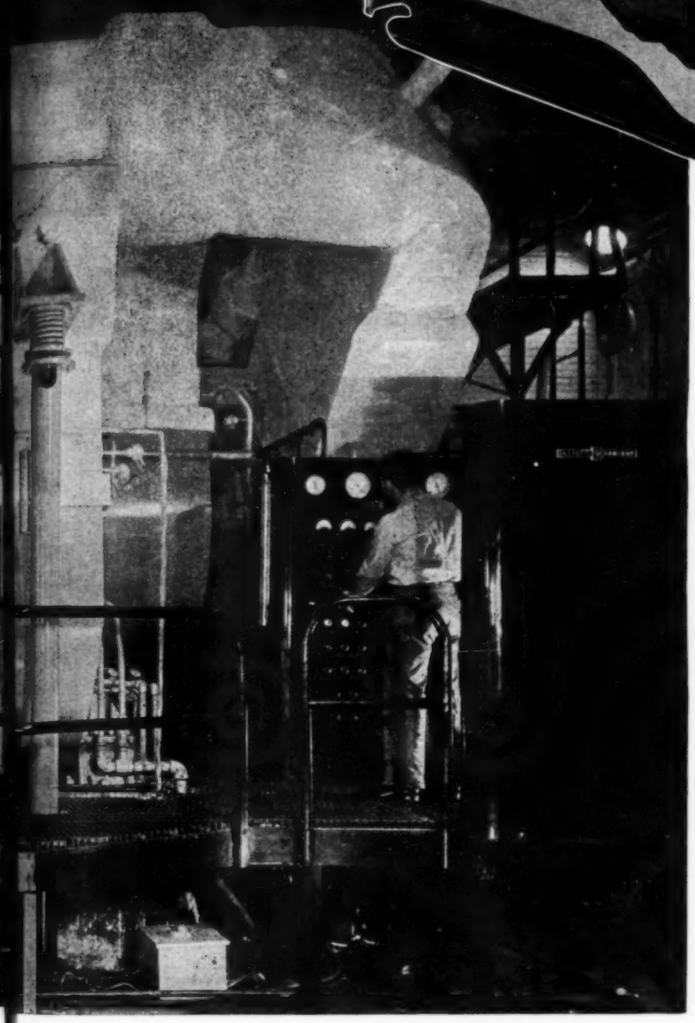


Proposed railroad locomotive application of Elliott gas turbine.



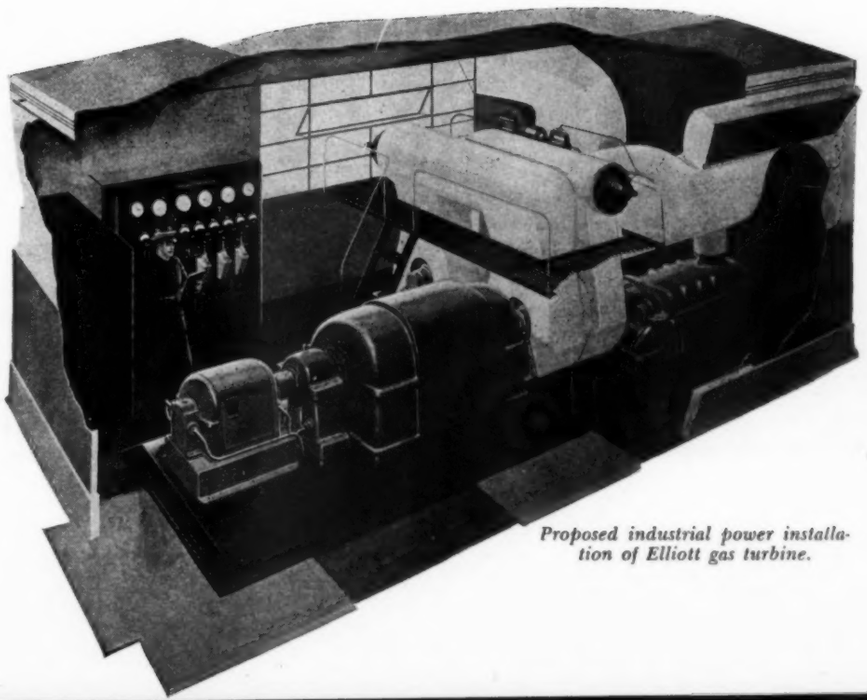
Proposed refinery application of Elliott gas turbine.



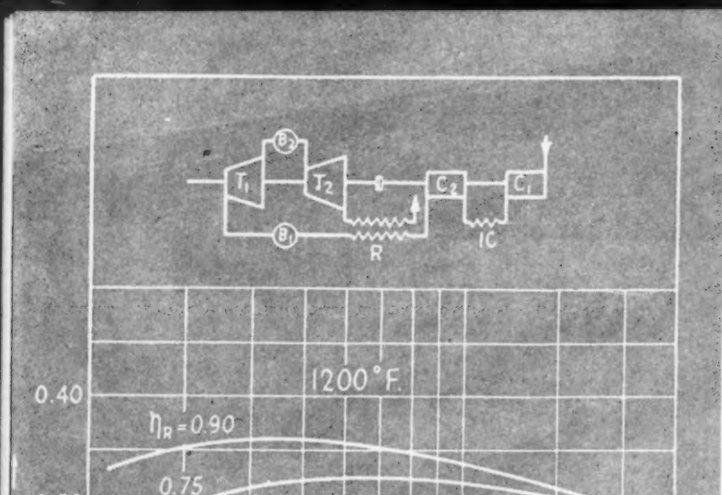
GAS TURBINE

come by modification of details. The weight of this plant is approximately 30 lb. per horsepower and it occupies a space of approximately 3½ cu ft. per horsepower.

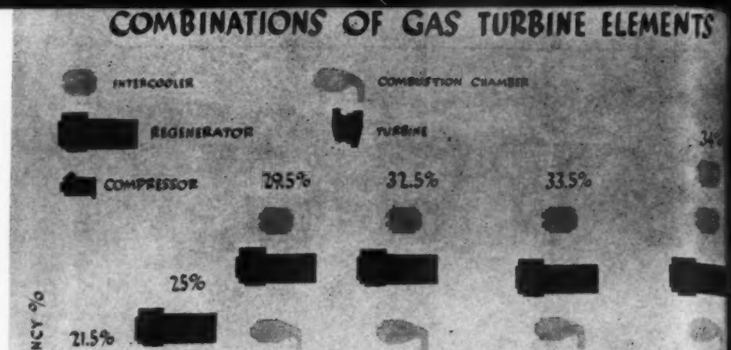
The plant consists of two turbines, two compressors with intercooling, two combustion chambers and a regenerator. To trace the cycle, the flow of gas begins at the low pressure compressor which takes in free air and compresses it to a pressure of 43 psi absolute and .300° F. The temperature is then lowered in the inter-



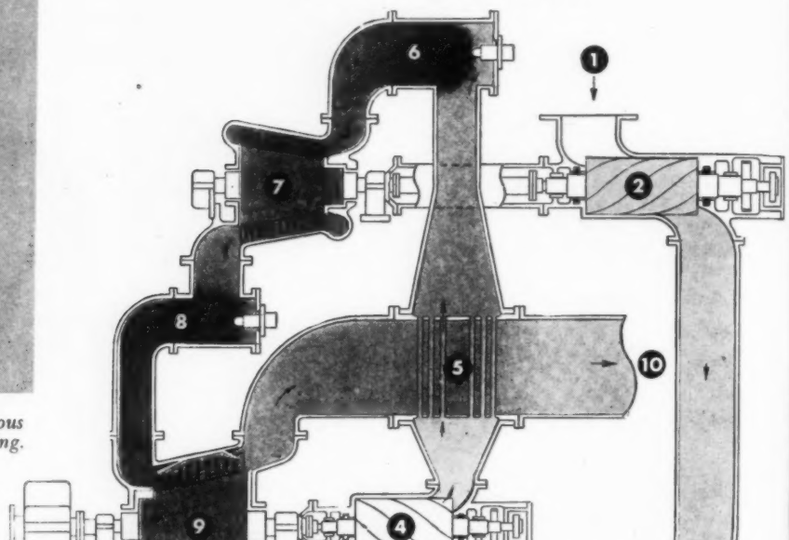
Proposed industrial power installation of Elliott gas turbine.



Efficiency of the cycle under discussion for 1200° F. and various regenerator efficiencies, showing effect of turbine compounding.



Note the combination of elements selected for the machine described here is shown fourth from the left.



Heat flow diagram; heaviest shading indicates where heat is added to the cycle. 1, Intake; 2, Low-pressure compressor; 3, Intercooler; 4, High-pressure compressor; 5, Regenerator; 6, High-pressure combustion chamber; 7, High-pressure turbine; 8, Low-pressure combustion chamber; 9, Low-pressure turbine; 10, Exhaust.

cooler from whence the air passes directly into the high-pressure compressor which raises the pressure to 96 psi absolute. The air then passes through the regenerator where a portion of the heat in the exhaust gas is returned to the air before it enters the high pressure combustion chamber.

In the high-pressure combustion chamber, fuel oil is burned directly in the air stream with a resultant temperature of 1230° F. at the entrance to the high-pressure turbine. In this turbine the heated air is expanded to 53 psi absolute, and in doing so, sufficient power is developed to drive the low-pressure compressor.

The air from the high-pressure turbine exhaust is then reheated in the low pressure combustion chamber bringing its temperature to 1207° F. before it is expanded with low-pressure turbine. Five thousand horsepower is developed in the low pressure turbine, 2500 hp. of which is expended in driving the high-pressure compressor—the balance, which is excess power is available for useful work, in this case to drive the propeller.

After the air leaves the low-pressure turbine at slightly above atmospheric pressure, it passes to the regenerator where it pre-heats the fresh compressed air from the high-pressure compressor. The exhaust gas at 400° F. is discharged to the atmosphere.

Since primary design considerations were based on Naval power plant requirements and such plants operate better than 90% of the time at other than full load, it is interesting to note that this plant has highly efficient part-load performance characteristics. This was achieved through the arrangement of machines wherein the two compressors are driven by separate turbines. With this arrangement complete control is obtained by regulating the fuel flow to the turbine driving the first-stage compressor. Since the amount of air which enters the system is controlled by this compressor, this feature produces ease of control and efficient operation of the main power turbine.

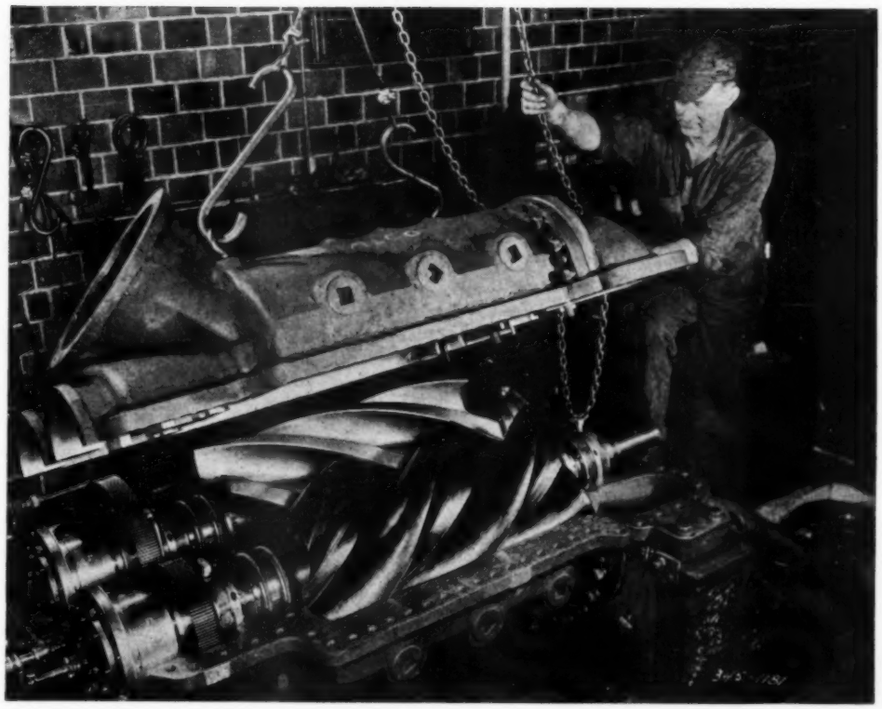
So much for the performance and physical make-up of the Elliott gas turbine. Many interesting facts were revealed regarding design, manufacture and materials of construction which are beyond the scope of this article. For the benefit of DIESEL PROGRESS readers we present excerpts from comments of Elliott Company spokesmen on "Gas Turbine vs. Other Prime Movers" and "Future Applications of Gas Turbines."

The first of the above subjects was discussed by C. Richard Soderberg, deputy head of the

Mechanical Engineering Department, MIT and consulting engineer for Elliott Company. Professor Soderberg said in part: ". . . The Elliott development was focused, from the start, upon a gas turbine plant which would be able to take its place among the existing prime movers with respect to fuel consumption, partial load and maneuvering characteristics, reliability, weight, and space requirements. . . . The result is a prime mover which falls into the class of Diesel engines with respect to fuel consumption; but which should approach the steam turbine plant in reliability and maintenance. "With respect to space and weight requirements it should be superior to both. . . . We are just starting a new chapter in the history of prime movers, we know that the chapter will be written, but its exact content is still hidden from us. Like all other inventions, the gas turbine will gradually and slowly find its proper place, and it is more than likely that this place will be one which neither the steam plant, nor the Diesel engine, occupy at the present time. . . ."

On future applications of gas turbines, Ronald B. Smith, vice president of engineering for Elliott Company said in part ". . . Many of us feel certain that the gas turbine, without displacing other forms of prime movers, has advantages that will win for it a wide sphere of influence. . . . In aviation the gas turbine fills a long unanswered need. . . . In the marine industry, by virtue of its light weight, compact size, efficient operation over a wide range, and its simplicity and potential reliability it is expected that the gas turbine will also find its sphere of influence. . . . There is little doubt that it would be immediately possible to bring forth an oil-burning gas turbine locomotive. . . . For years, engineers in the power industry have been intrigued by the thought of 'packaged' power units complete unto themselves. . . . The gas turbine, by virtue of its freedom from cooling water demands, is ideally suited to installations of this type. . . . In . . . is shown a preliminary plan for a refinery installation with a single turbine driving three identical displacement compressors . . . the future of the gas turbine appears promising. But . . . there remains much to be done before the gas turbine earns its place. . . ."

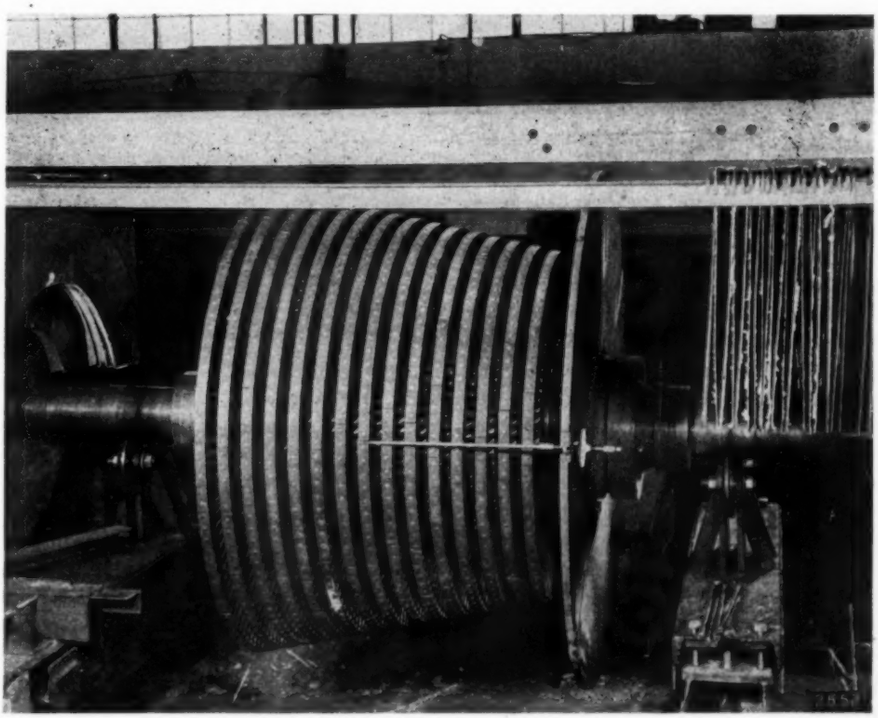
Now that there exists a working power-producing gas turbine plant, the characteristics—yes the innermost secrets of which have been revealed through the good offices of the Elliott Company and the U. S. Navy, DIESEL PROGRESS will offer its readers a cold comparison of the gas turbine and Diesel engine by an eminent authority in an early issue.

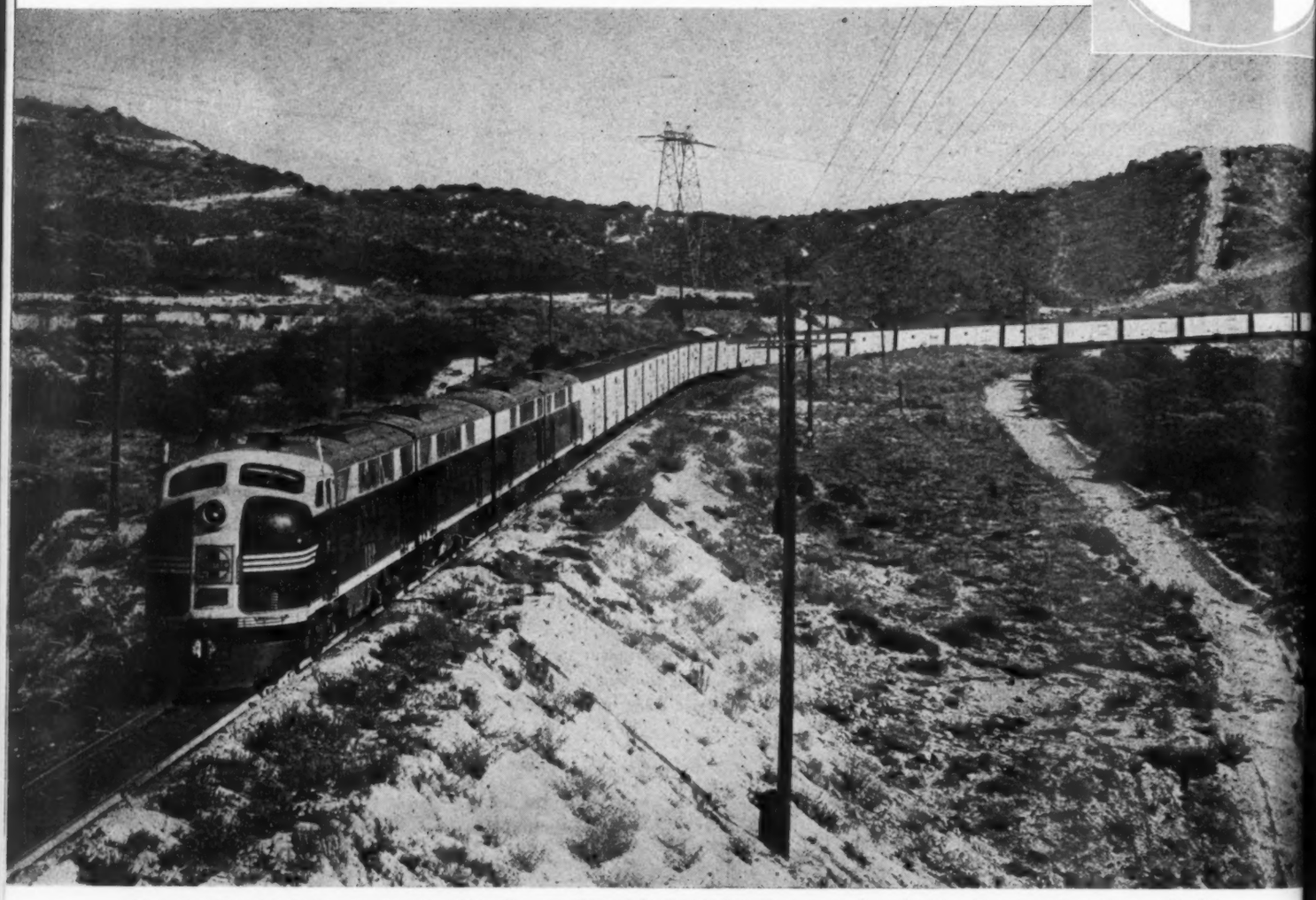


A vital element is the Elliott-Lysholm compressor, seen here with upper half of casing removed.

We close with one more thought expressed by Professor Soderberg: "The steam plant and the Diesel engine will probably continue to be important in their respective fields, but the presence of the new contender is also likely to precipitate important developments in these prime movers." These developments will be most interesting to watch.

The gas turbine rotor is shown here undergoing balancing tests.





Santa Fe's Diesel-electric locomotive No. 110 pulling a solid trainload of California oranges through Cajon Pass enroute to Eastern Markets. All photographs in this article are Santa Fe photos.

578,960 Hp. With 93,000 Hp. On Order!

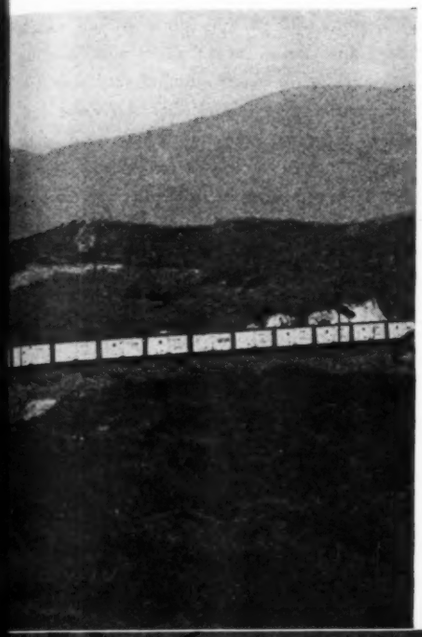
By CHARLES F. A. MANN

TEN years ago, the Santa Fe Railway received its first Road Diesel, a 3600 hp. 2-unit locomotive fresh from the Cleveland shops of Electro-Motive Corporation. In January of that year, it also received its very first Diesel switcher, a 600 hp. Alco Diesel, from Schenectady. Following the Biblical maxim, "The Last Shall Be First," this great System, with its 13,000 miles of Mainline sprawled over America's vast Southwest, from Chicago to the Pacific Ocean and the Gulf of Mexico, timidly, at first, "felt the pulse" of Diesel . . . it lagged rather far behind the Burlington and the Union Pacific in their historic plunge into Diesel streamliners. Then, with characteristic caution as a tight brake on its famous tactics for plunging on an amazing scale the Santa Fe realized its peculiar topographic and climatic handicaps, plus its famous hold on large-scale passenger traffic and set the stage for Diesel on an almost fabulous scale.

Now, exactly ten years later, from this lone 3600 hp. Diesel, old Nos. 1 and 1A, still running after over 2,000,000 miles of hectic service as Guinea Pigs for the whole System, the Santa Fe Diesel fleet has grown to 226 Diesel locomotives totalling 578,960 horsepower, plus an additional 22 large passenger Diesels and one 1,000 hp. Fairbanks Morse switcher yet on order, totalling 93,000 hp.!

It was not until June, 1936 that the first Super Chief blossomed out, with a regular weekly Chicago-Los Angeles 39 hour schedule, and nearly a year later before three 3600 hp. passenger Diesels were at work on the Santa Fe. By 1938 the spectacular fleet of stainless steel Streamliners, including the 2nd Super Chief, El Capitans, San Diegans, Golden Gates and Kansas Cityans and Chicagoans were in service.

SANTA FE OPERATES WORLD'S GREATEST FLEET OF DIESEL LOCOMOTIVES



long ago dubbed it the "Prince and Pauper" System, because, with the varying cycles of Far West economic growth, the Santa Fe alternately found itself bursting with traffic and prosperity, and narrowly "getting by" with barely enough annual gross to keep going. Through three generations of shrewd management there has grown up an almost indefinable Santa Fe tradition that makes this railroad not only the darling of the public, particularly in passenger traffic, but also one of the world's outstanding public relations conscious corporations. All this traces directly back to the peculiar gyrations of its business cycles, and the awareness of its management that when the going gets tough, the whole company must rise

John P. Morris, general mechanical assistant and "Big Boss" of Santa Fe's mighty Diesel fleet at the throttle of an Electro-Motive 5400 hp. locomotive with R. M. Dilworth, Electro-Motive's chief engineer, looking on.

and 9 more 1800 hp. Diesel units from Electro-Motive were added to the fleet. The company, sensing its Diesel destiny, had by the advent of the Streamliner Year 1938 a corps of 19 trained Diesel Maintainers spread thinly throughout the System, training more men in the new technique of Diesel railroading.

As great railroads go, the Santa Fe is safe in its niche among the first six of all the railroads of the world. Financial moguls in Wall Street up and sell its services to the public, as merchants of transportation and public service, without waiting for the Eastern Seaboard, world conditions or politics in Washington to dump a lifesaving windfall into their coffers to help them over the hump.

Long ago, before the last World War, the Santa Fe began a far-reachng plowback of its surplus revenues in time of prosperity into debt reduction and plant improvement, at times reaching proportions of a huge construction project not seen in this country since the railroad era began. Sensing that World War II was soon due, the Santa Fe, this time, realized that the next prosperity wave required plowback of profits into creation of a railroad that would be ready for war and for the postwar age of air and highway competition, so it began killing two birds with one gigantic stone—making its roadbed a 100 mile per hour speedway and its rolling stock capable of that 36 hour passenger and 72 hour freight Chicago-Coast schedule a reality.

So it plunged into Diesel for two reasons: To equip its motive power department to do things with this new power that could not be done with steam or electricity; and to provide a safe, economical "hedge" against declining traffic and possible rate-battles, by having Diesel's inherent economies, reliability and availability ready to spread thinly out over the whole System, to provide the most economical operating setup possible to visualize, in event the postwar dreams of the U.S.A. follow the usual postwar patterns that history shows always come in the wake of inflated wartime spending . . . long periods of declining traffic throughout the System.

The Santa Fe System has emerged from this war period with a remarkable capital structure; a Diesel fleet larger than the combined Diesel fleets of the next four Diesel-minded railroads combined; a grasp on high-speed transportation based on practical economics and keen insight into what's going on inside Joe and Jane Citizen's mind when peace comes, it will trot out the glorious, charming old Fred Harvey legend; repaint in gold, white and blue the Santa Fe trademark on everything owned within its vast empire of land, rails, rolling stock and hotels; dust off its wondrous Indian legends and animate them with Mr. and Mrs. Indian Chief Jr. and keep on rolling up fabulous passenger, express, freight and perishable cargo handling records right under the noses of airplanes, trucks, buses and private autos!

Practically every U. S. railroad is downright jealous of the Santa Fe. Many dozens of brilliant railroad ideas have been dreamed up and allowed to die on the vine. But somehow the

Santa Fe sniffs and prods and digs the good ones out and, swiftly, the management, instead of letting these ideas rot in "committee," tells its staff: "Sure, go ahead, if you think it will work." . . .

How this works is beautifully evident in building its Diesel fleets. Dozens of railroads had Diesel switchers before the Santa Fe. Many had Diesel passenger trains. But it remained for the Santa Fe to team up joyfully with General Motors and trot out the world's first Diesel freight locomotive in January 1940; buy the first 5400 hp. Diesel freighter in December 1940 and start the world's first Diesel freight service in February and March 1941. It never regarded Diesel as a "new thing," but as an answer to a railroad problem, hitherto apparently unsolvable.

Relegated by the 19th Century railroad feuds in the West to a transcontinental crossing across an almost barren plateau, stretching from Western Kansas to the Colorado River, upon which is to be found every type of mountain, canyon and desert, the Santa Fe's route has been a topographical nightmare to its operating department. The first 1285 miles of its freight route, via Amarillo, Texas, is a dream. The next 925 miles, after it joins the passenger route via La Junta, Colorado and Raton Pass, is a plain headache. When traffic is light, the meager desert water supply in the rugged mountain territory between Winslow, Arizona, and Barstow, Cal., is barely adequate to run a steam railroad, not to mention innumerable tourist enterprises. But when traffic doubles and redoubles, the cost of locomotive water in a single year may reach two to three million dollars. In a region of little coal, the Santa Fe has always, on its

T. T. Blickle, youthful supervisor of Diesel engines, Atchison, Topeka & Santa Fe Railroad.

major stretches of track, been an oil burning system. At first this was a handicap, but as the age of Diesel dawned, it left one of the four largest railroads in the U.S.A. 100% free, and hands completely untied, to dip into the new sources of motive power without worrying over the blood pressure of various coal mine owners along the line.

In a region of little rainfall, and prior to the construction of Boulder Dam, hydroelectric or steam-generated electric power was out of the question. Then, with the varying load-factor of railroading through the desert, both seasonal and varying with the years, even cheap electric power cost too much to even consider from a traffic standpoint. So it remained for the Diesel freight locomotive, with regenerative electric braking, to solve one of the very worst of the Santa Fe's problems in hauling freight over the four major divides between Winslow and Los Angeles—getting freights downhill! You can pile power enough on a freight train to get 125 cars uphill, but nothing was heretofore invented to get this heavy train down to the bottom without long stops to cool wheels or replace broken brake shoes that literally melted off in the torrid summer sun, plus friction generated in grades that were one continuous downhill slide for distances up to 60 miles! The Santa Fe pioneered with the regenerative (dynamic) brake and for good reason—it embodied half the basic reasons for deciding to plunge heavily into Diesel!

Diesel No. 100 went to work in 1941 hauling Santa Fe freights on every kind of System routes, from the rolling tracks across Illinois and Kansas, to the worst Western mountain grinds and in every kind of weather. Soon 4 more 5400 Electro-Motive Diesels were received, one of which had the first of the new type brake controls that permitted instant application at any speed.

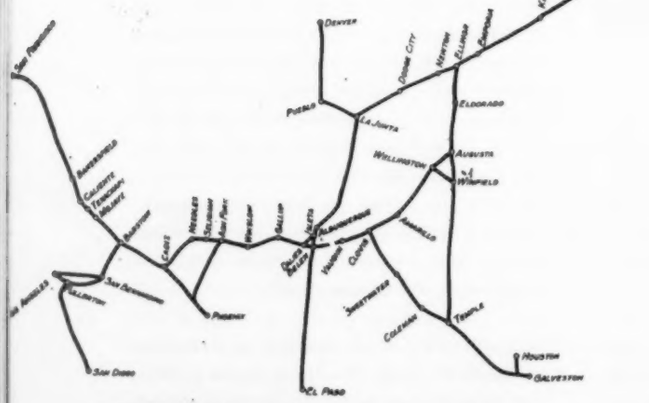
The accompanying profile map of the Santa Fe showing its Western mountain grades and the very excellent operating record of freight Diesel No. 100, supplied by John P. Morris, the "big boss" of Diesel on the Santa Fe System, will graphically give the reader the whole groundwork picture of the whys and wherefores of Diesel development that has since given rise to the great fleet now at work on the 10th anniversary of the first two Diesels.

Total April 1941 to March 1945, Inclusive

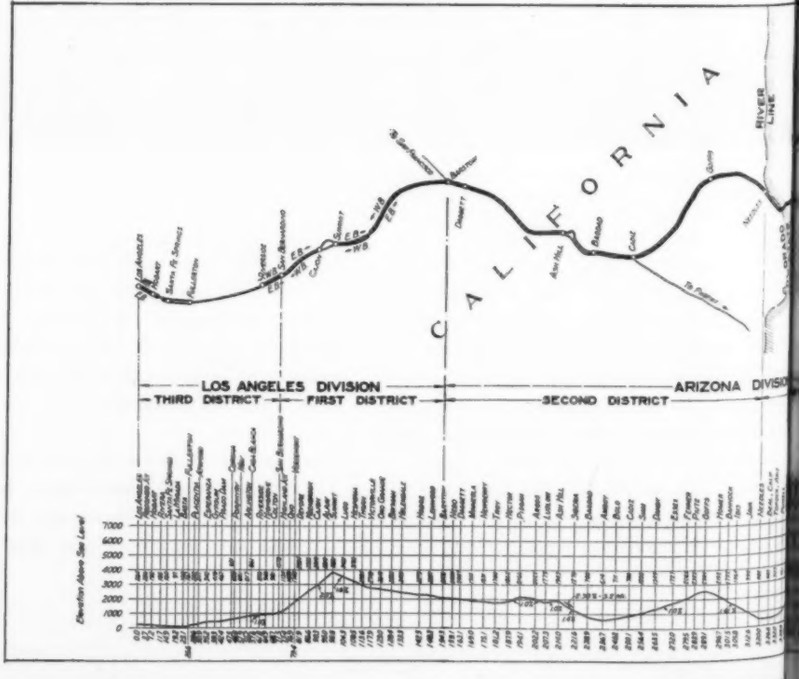
DIESEL NO. 100

Train Miles	484,677
Total Locomotive Miles	494,137
Locomotive Unit Miles	1,933,142

SKETCH SHOWING
MAIN LINES OF
THE A. T. & S. F. RY. SYSTEM



Notes: (See Profile).
The controlling ascending or ruling eastbound or westbound grades are shown immediately below the grade line.
Immediately above the grade line are shown all descending grades between Barstow and Belen which would control tonnage if trains were run against the current of traffic on double track and which exceed (a) 1.42% west of Winslow and (b) 0.60% east of Winslow. Arrows pointing easterly indicate grades on eastbound track and arrows pointing westerly indicate grades on westbound track.



Car Miles—Total	39,018,159
Locomotive Hours Available	29,952
Fuel Consumed (gallons)	3,333,465
Lubricants for Locomotives (gallons)	80,458
Gross Ton Miles (thousands)	1,636,076
Gross Ton Miles per Train Mile	3,376
Repairs	.430
Total Loco. Expense per 1000 gtm.	.376

1944 Mileage—107,672

Locomotive Repairs

Diesel Engines	—Labor	$71,073
	—Material	51,190
Electrical Equipment	—Labor	34,625
	—Material	21,081
Other Repairs	—Labor	21,116
	—Material	13,596
Total Repairs		212,688
Depreciation		124,844
Wages—Enginemen and Helpers		95,467
Fuel		140,775
Water		1,784
Lubricants for Locomotives		36,297
Other Locomotive Supplies		1,085
Enginehouse Expense		12,734
Total Locomotive Expense		$625,682

While Diesel 100 made mileage beginning January of 1941, there is no statistical report available before April of 1941.

It will be remembered that DIESEL PROGRESS followed the passenger and freight Diesel progress on the Santa Fe from the beginning. . . . After the initial streamliner Diesel program got under way, the Diesel switcher program began in earnest. The Santa Fe has not ordered a single new steam switcher in the past 8 years. In 1940 two more 1,000 hp. Electro-Motive Diesels were ordered for passenger service, and in 1941, 3 more Electro-Motive-General Motors 2,000 hp. passenger units and two 2,000 hp. Alco passenger units were placed in service. War stopped expansion of the passenger fleet in 1941, and from then on the freight fleet grew quietly and steadily to cope with the terrific increase in freight traffic incident to war. Eleven were added in 1942; 16 in 1943; 29 in 1944 and 7 in January and February 1945, plus 10 more in the past summer months. Meanwhile the switcher fleet grew rapidly, in later years largely the 1,000 hp. sizes, plus 9 small 44 ton G.E. switchers of but 380 hp. for light industrial and small-town switching use.

With war loads as the chief impetus, Diesel statistics on the Santa Fe almost require the study of higher mathematics or use of tables developed by astronomers. As the war load mounted, the Diesel picture kept moving Westward, until the summer of 1944 found a perfect example, the very first example of the emergence of the world's first all-Diesel railroad, on the traffic bottleneck between Winslow, Arizona, Barstow, San Bernardino and Bakersfield, California, a total of 680 miles of double track main line, embracing all the heavy grades and severe operating problems of the whole System.

Before analyzing this huge Diesel operation, let the record speak for itself:

DIESEL LOCOMOTIVES ON THE SANTA FE

	Number	Horsepower	Total Horsepower	Builder
Freight:	78 (312—1,350 Hp. Units)	5,400	421,200	E-M Division of Genl. Motors
Passenger:	4	3,600	14,400	Electro-Motive
	5	1,800	9,000	Electro-Motive
	4	4,000	16,000	Electro-Motive
	1	4,000	4,000	American Locomotive
	1	2,000	2,000	Electro-Motive
	15		45,400	

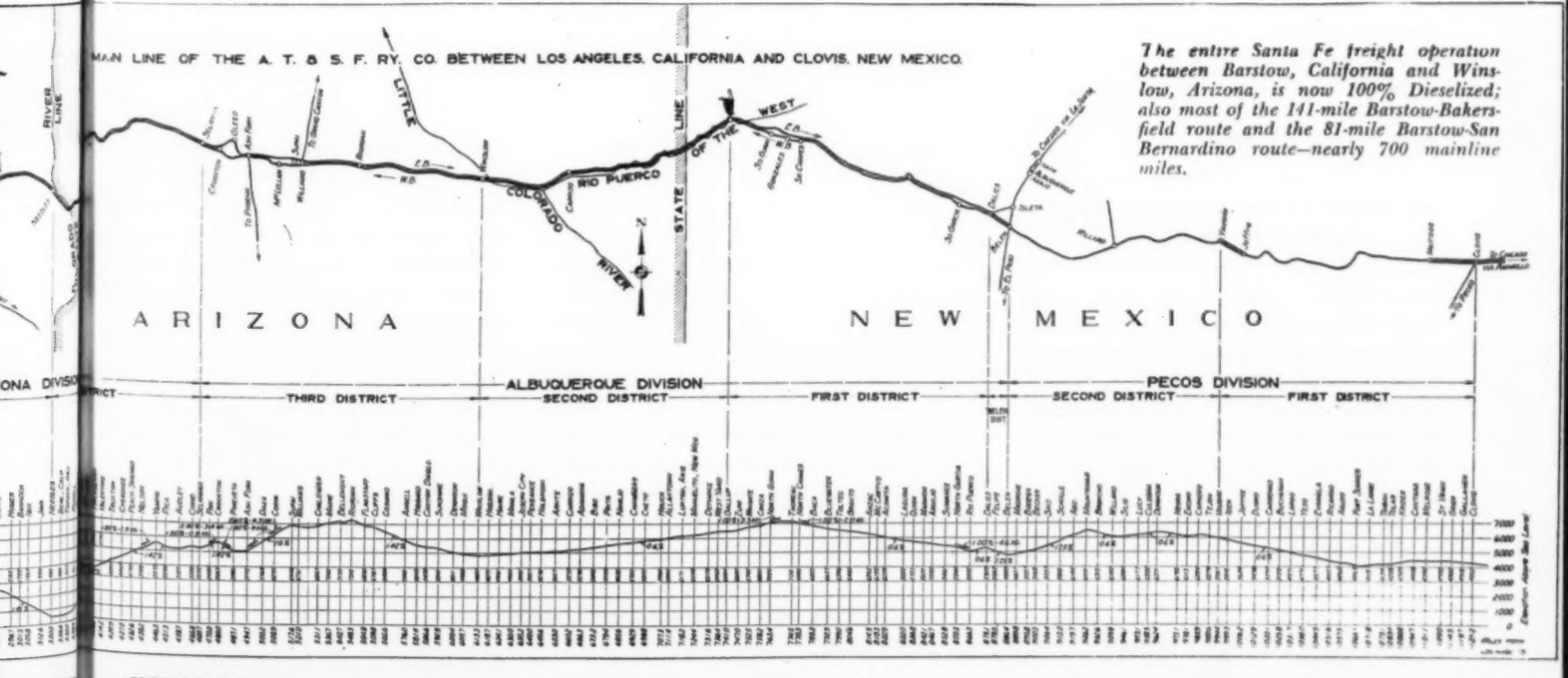
(24 Units—9 Multiple Unit Psgr. Locomotives)
6 Single Unit Psgr. Locomotives)

Switch:	1	360	360	Whitcomb
	1	360	360	Davenport
	9	380	3,420	General Electric
	4	600	2,400	Electro-Motive
	3	900	2,700	Electro-Motive
	15	1,000	15,000	Electro-Motive
	47	1,000	47,000	Baldwin
	3	600	1,800	American
	2	660	1,320	American
	38	1,000	38,000	American
	123		112,360	
Total All Types:	216		578,960	

DIESEL LOCOMOTIVES ON ORDER FOR SANTA FE

Passenger:	20	4,000	80,000	Electro-Motive
	2	6,000	12,000	American Locomotive
Switch:	1	1,000	1,000	Fairbanks Morse
	23		93,000	

This huge existing Santa Fe fleet is now producing Diesel records in calculus-quantities! The company now has nearly $45,000,000 invested in Diesel. The 78 Diesel freighters if stretched out in a solid string would extend over three miles! The sight of a train extending as far as from The Battery, at the lower end of Broadway, in Manhattan, clear up to Union Square—if you will, and costing nearly $30,000,000, might better enable the reader to grasp what it means. This huge fleet will move 78 freight trains, each a mile long, the distance between New York and Pittsburgh, every 24 hours! The 124 Diesel switchers and the 24 passenger units would string out to another 1½ miles and raise the cost another $12,000,000. At Winslow, Arizona, where a $500,000 new shop facility is nearing completion, over 1½ million gallons of fuel oil and 50,000 gallons of lubricating oil is pumped into the Diesel fleet every three weeks. More than 4,000 of the huge army of Santa Fe employee forces are now specifically trained with Diesel motive power—the largest single army of Diesel trained personnel in the world. . . . Diesel switchers now operate at 33 of the very largest Santa Fe terminals, and within 5 years after the end of this war, not a single steam switcher is expected



The entire Santa Fe freight operation between Barstow, California and Winslow, Arizona, is now 100% Dieselized; also most of the 141-mile Barstow-Bakersfield route and the 81-mile Barstow-San Bernardino route—nearly 700 mainline miles.

to be running on the whole System. Addition of twenty 4,000 hp. Diesel passenger locomotives will enable the main Transcontinental fleet of passenger trains operating west of La Junta to be 100% Dieselized, and the high-speed fleet leaders will be 100% Diesel operated all the way to Chicago.

SANTA FE DIESEL MILEAGE RUN AS OF MARCH 1, 1945

(15 Passenger; 68 Freight and 124 Switchers)

In Freight Service	10,513,473 Miles
In Passenger Service	19,500,000 Miles
In Switching Service	16,713,957 Miles
Total	46,727,430 Miles

Keep in mind that 29 of the 5400's were not delivered until 1944 and 10 more until January and February of this year. The greatly augmented fleet now delivers over 1,150,000 miles per month—the greatest monthly Diesel mileage, etc., etc.!

And it must also be remembered that the terrific terrain over which the freight fleet operates, which necessitates running only at moderate speed both uphill and downhill, brings down the average speed to just under 20 miles per hour—averaged over the whole fleet, except Nos. 100 and 101 which run in the flat country because of the old two-position regenerative brake, which is not flexible enough for mountain work.

The following table covering the 58 freight units, for 1944 is of great interest, particularly in that it covers heavy extra repairs to cooling water systems, radiators, etc., due to damage by alkali water and wartime depreciation, incident to the high cost of initiating the all-Diesel service during 1944. It must be borne in mind that these costs aren't the true picture of a combined fleet operation that will naturally come down as facilities are perfected and their costs properly amortized.

1944 CUMULATED TOTALS FOR DIESEL FREIGHT LOCOMOTIVES— NOS. 100 TO 158 INCLUSIVE

Train Miles	5,346,558
Train Hours	270,486
Locomotive Miles, Principal	5,346,411
Locomotive Miles, Other	219,428
Locomotive Unit Miles	21,884,000
Car Miles Loaded	248,352,444
Car Miles Empty	113,338,210
Car Miles Caboose	5,703,618
Car Miles, Miscellaneous	802,757
Total	368,197,029
Gross Ton Miles	15,699,986,000
Net Ton Miles	6,246,445,000
Locomotive Hours Available	351,958
Gallons Fuel Used	40,707,447
Gallons Lube Oil	693,079
Car Miles Per Train Mile	68.9
Gtm. per Train Mile	2,936
Gtm. per Train Hour	58,044
Train Miles per Hour	19.77
Per Cent Availability	84.93
Per Cent Available Hours Utilized	76.85

PER MILE COSTS

Repairs	.538
Depreciation	.265
Wages	.241
Fuel	.302
Water	.012
Lubricants	.055
Supplies	.002
Engine House Expense	.039
Total Expense	$1.454
Total per 1,000 Gross Ton Miles	.516
High 1944 Mileage No. 132	116,215

In 1944 the Santa Fe's passenger fleet of 15 Diesels, comprising a total of 24 units, turned out a remarkable performance. The following table gives a pretty sound idea of how these 1,800 hp., 2,000 hp. and 4,000 hp. units (or 3,600 hp. combinations) worked out. The following tables are averages for the whole fleet, as to size, number of cars pulled, overall costs, etc.

1944 CUMULATIVE TOTALS FOR 15 PASSENGER DIESELS

Train Miles	2,681,362
Locomotive Miles	2,707,879
Locomotive Unit Miles	5,078,808
Car Miles	28,777,284
Gtm.	1,620,667,000
Fuel Used, Gallons	7,719,957
Lubricants, Gallons	192,986
Car Miles per Train Mile	10.7
Gross T.M. per T.M.	604

EXPENSES PER LOCOMOTIVE MILE

Repairs	.370
Depreciation	.106
Labor	.188
Fuel	.122
Lubricants	.031
Supplies	.008
Engine House Expenses	.029
Cost per Locomotive Mile	.851

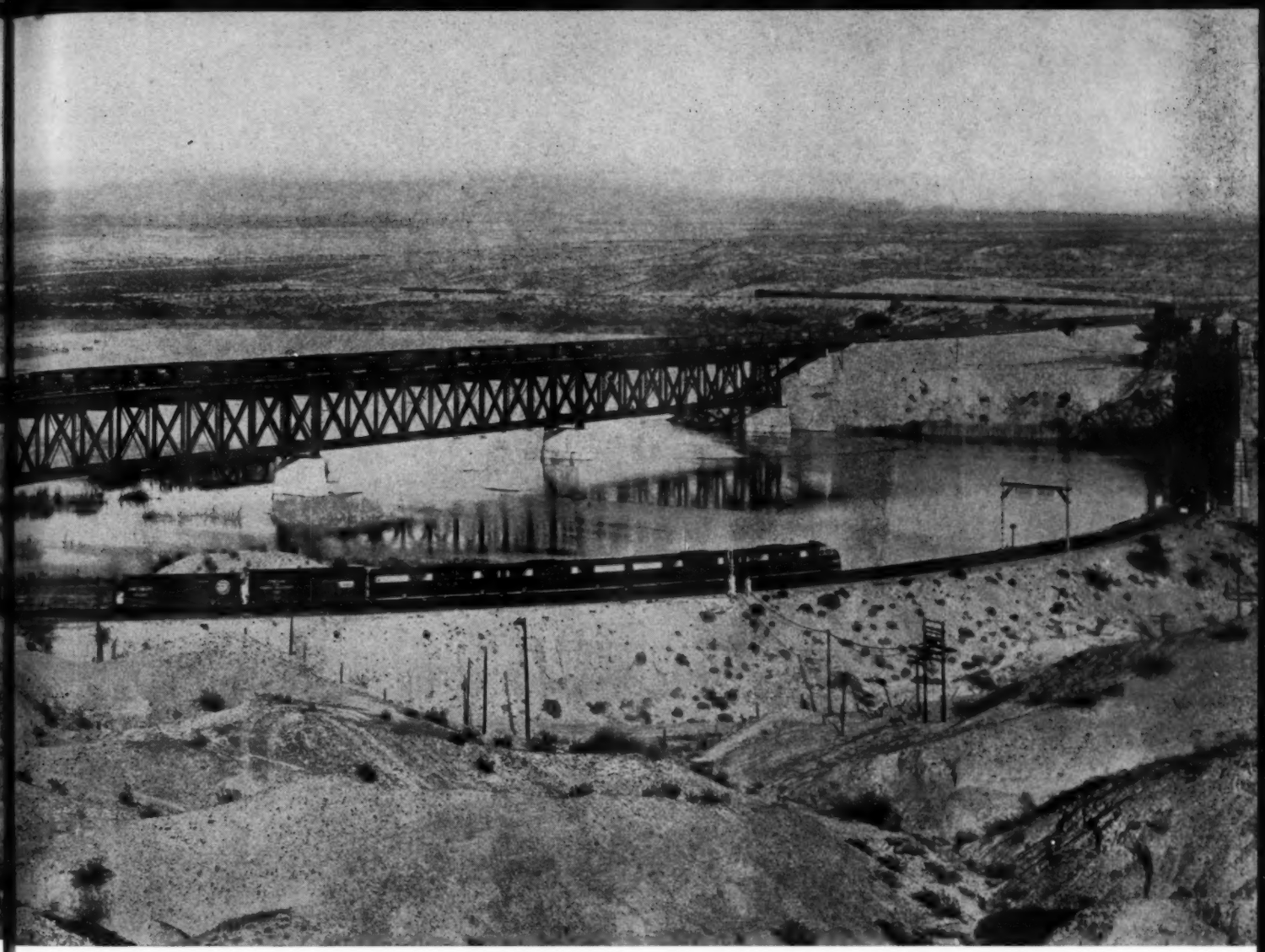
It is interesting to observe that while the Super Chief and the El Capitan, the all-Pullman and the All-Coach de luxe Diesel streamliners that operate twice weekly in each direction between Chicago and Los Angeles would,

at first glance, seem to naturally absorb the high Diesel mileage for the System, it does not hold true. The Coast trains each piled up approximately 950,000 miles in 1944 while the Kansas Cityan—Chicagoan Coach train really did the big mileage for that year, piling up almost 1,500,000 Diesel miles.

The following table gives the 1944 breakdown on Diesel passenger mileage on the Santa Fe.

MILES RUN, HANDLING, HELPING OR RUNNING LIGHT, WITH FOLLOWING PASSENGER TRAINS, YEAR 1944:

Super Chief	945,691
El Capitan	953,880
KC-Chicagoan	1,482,871
Tulsan	186,129
San Diegan	738,310
Golden Gate	438,422
Chief	272,400
Grand Canyon	914
Ranger	16,436
Scout	1,828
Calif. Ltd.	6,855
Fast Mail	27,309
Other	7,853

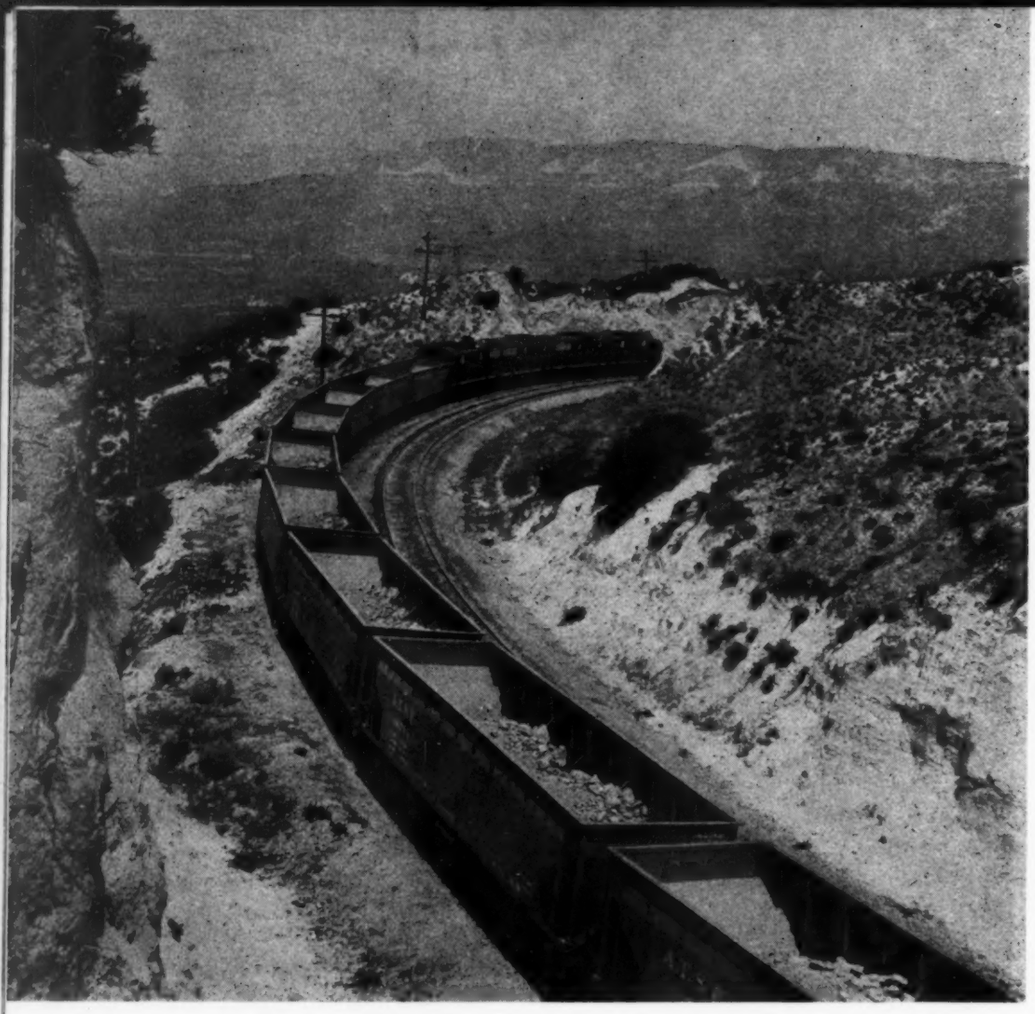


Two Diesel-electric freighters crossing the Colorado River, one on the new Santa Fe double-track bridge, the other approaching the old bridge completed in 1890.

Any appraisal of the Santa Fe Diesel program must take into consideration a unique fact, namely that this railroad enjoys an almost phenomenally large passenger revenue, or rather passenger train revenue, as Western Systems go, and also as compared with other railroads of similar size throughout the world. Therefore, it is unfair to point to the wartime freight load, that boosted total revenues to over $379,000,000 in freight alone, in 1944, and give it 100% of the credit for a successful year of railroading performance. Ever since the streamliner era began on the Santa Fe, passenger revenues have mounted rapidly, freight revenue in 1938 stood at $124,139,642, while passenger revenue was $16,896,756. In 1944 freight revenue climbed just under 300% to about $380 million while passenger revenue climbed 700% to a total of over $112 million! Last year passenger, mail, express and miscellaneous revenue, largely dependent on passenger train operation, amounted to nearly 40% of the gross income of the Santa Fe! Conclusions are obvious: Santa Fe has too much of a stake in passengers not to integrate its motive power planning thoroughly into the entire picture. Hence Diesel freight and Diesel passenger will likely fit together into an unusual pattern of operation after the war. Where most Western lines are counting on a drop to 95% freight and 5% passenger revenue, the Santa Fe can probably merrily go along on a 25% passenger and 70% freight forecast, and do a positively astounding job with its fleet of Diesels. Remember, all you have to do is to change gear ratios, raise wheel sizes 2 inches and install a heating boiler, and presto, those 5400's now hauling freight will haul the Scout, the Fast Mail, the Grand Canyon, the California Limited and even the Chief, on an expenditure of not to exceed $10,000 per locomotive for the conversion.

By the same yardstick the Santa Fe may well emerge as the first railroad to operate a streamlined Diesel merchandise freight train—Chicago to Los Angeles in 48 hours, at 22 cents per ton mile revenue. Whichever way the wind blows, the Santa Fe can do it with their flexible Diesel operation . . . that's why 70 of the Nation's railroads have sent "observers" out to take notes and go back and toss bombs under Boards of Directors indolent seats.

The two widely divergent transcontinental routes, one via Oklahoma and the Texas Panhandle and the other via Raton Pass, join at Dailies, N. M., just west of Albuquerque. From Dailies to Winslow, the double tracked mainline, while a bottleneck containing the entire transcontinental traffic of both freight and passenger routes, is a region of relatively light grades, being only .6 of 1%, Westbound, for the entire 260 miles, including the Continental Divide crossing at 7,244 ft. just west of Gallup, N. M. However, at Winslow, real rugged terrain begins, and the next 459 miles to Barstow, Cal., is one continuous up-and-down. A grade of 1.42 per cent begins at Winslow, at an elevation of 4,855 ft. and continues unbroken to the summit at Riordan, 7,310 ft. altitude, 65 miles west of Winslow. From there a generally brok-



Electro-Motive 5400 hp. Diesel freighter pulling an ore train over Cajon Pass on the Santa Fe.

en descent drops the line to Williams, then a sharp rise to Supai Summit; then 19.6 miles to Ash Fork, with a drop of 1,804 ft. down a 2.6% grade for 10 miles then 1.8% the remainder.

It is estimated that it cost the Santa Fe $50,000,000 to get its freight trains down hill in the past 50 years prior to the advent of cool brake shoes and regenerative braking.

Practically this whole territory required doubleheading in both directions, and in an area of acute water scarcity the water requirements were tremendous under steam power. Beyond Barstow, while water was more plentiful on the Coast, even worse grades on the 80 mile route over Cajon Pass to San Bernardino and the 140 mile run down to Bakersfield, over Tehachapi Pass, created a 683 mile mountain railroad ideal for Diesel. Steam locomotives rarely could handle in excess of 2,000 tons over any part of the area while the 5400 Diesels haul up to 3,500 tons without a helper except over Tehachapi and Cajon Pass and the 23 miles of 1.8% grade from Ash Fork to Supai. In prewar years, with the line handling only one-third as much traffic as it does now, it was necessary to haul 1,000,000 gallons of water into Ash Fork daily. But 360,000 gallons of water are hauled in daily now to handle steamers on the passenger trains and all trains on the Phoenix branch. It used to take 15 cars of water a day into Angell, but now it is reduced to but 3 cars. During certain seasons it was necessary to haul water into Williams, too. But all this is eliminated now.

So, as the war load rose and kept on rising . . . rising from 4,206,320,000 gross ton miles on the Albuquerque and 4,042,384,000 gross ton miles on the Arizona Divisions, the two divisions covering the Winslow-Barstow section—in 1939, up to 13.8 billion gross ton miles on the Albuquerque and 12.8 billion gross ton miles on the Arizona Division in 1944, the Diesel freight picture moved solidly to this one bottleneck section of the Santa Fe.

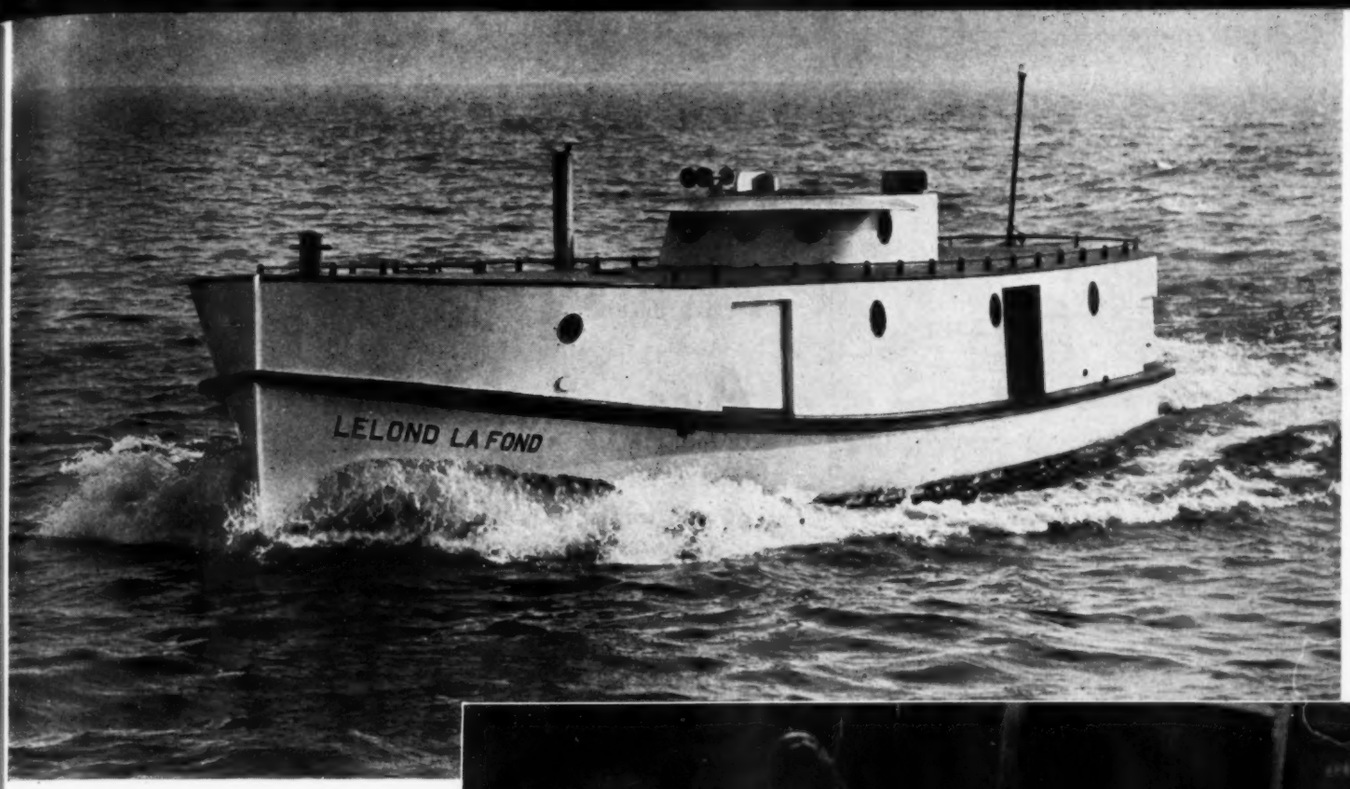
To better understand it in simple terms, the gross ton miles rose 300% while the net ton miles rose 500% . . . one day last November 1,644 carloads of freight went west out of Winslow yards. This is about 33 trainloads. An equal number of freights came east through Winslow, not to mention nearly 30 passenger trains. All these astronomical statistics taking place while the company faced the worst manpower shortage in its history.

The resulting drive to clear the tracks with Diesel has given rise to relatively high average availability—91.5% for the entire fleet. When traffic drops slightly, some Diesels run clear east to Belen, and more were pushed on to Bakersfield and San Bernardino an advantage of Diesel and Diesel alone. Water stops in the 459 mile territory averaged 9 to 10 per locomotive per trip, with another stop if the steamers went through to Los Angeles. With Diesel they fill up at Winslow, get a touchup at Needles if forced to lay over, and then at Barstow, or San Bernardino, depending on which way the trains are headed. But no more than one fuel and water stop is necessary on the entire 459 mile run! Freight trains of 3,500 tons are now handled over the entire distance in from 14 to 20 hours, a reduction of nearly half in the former running time with steam power and its attendant helpers. Half the light-engine traffic formerly resulting from empty helper moves downhill, have been eliminated. Track capacity, when the full force of the 78 Diesel freighters is in effect, and the huge new shops at Winslow and Barstow are completed and functioning in proper rhythm, will be more than doubled due solely to Diesel. Saving in water costs alone is estimated to pay for all the lube oil and one-third of the Diesel fuel oil consumed by the fleet of 78 Diesels.

Back of all this splendid performance, which so abruptly took over the Santa Fe's war load in the nick of time, is the smoothly coordinating planning at work in the mechanical department in Chicago, headed by John P. Morris, "Diesel boss" of the System, and his youthful aide, T. T. Blickle, Supervisor of Diesel engines for the whole Santa Fe System.

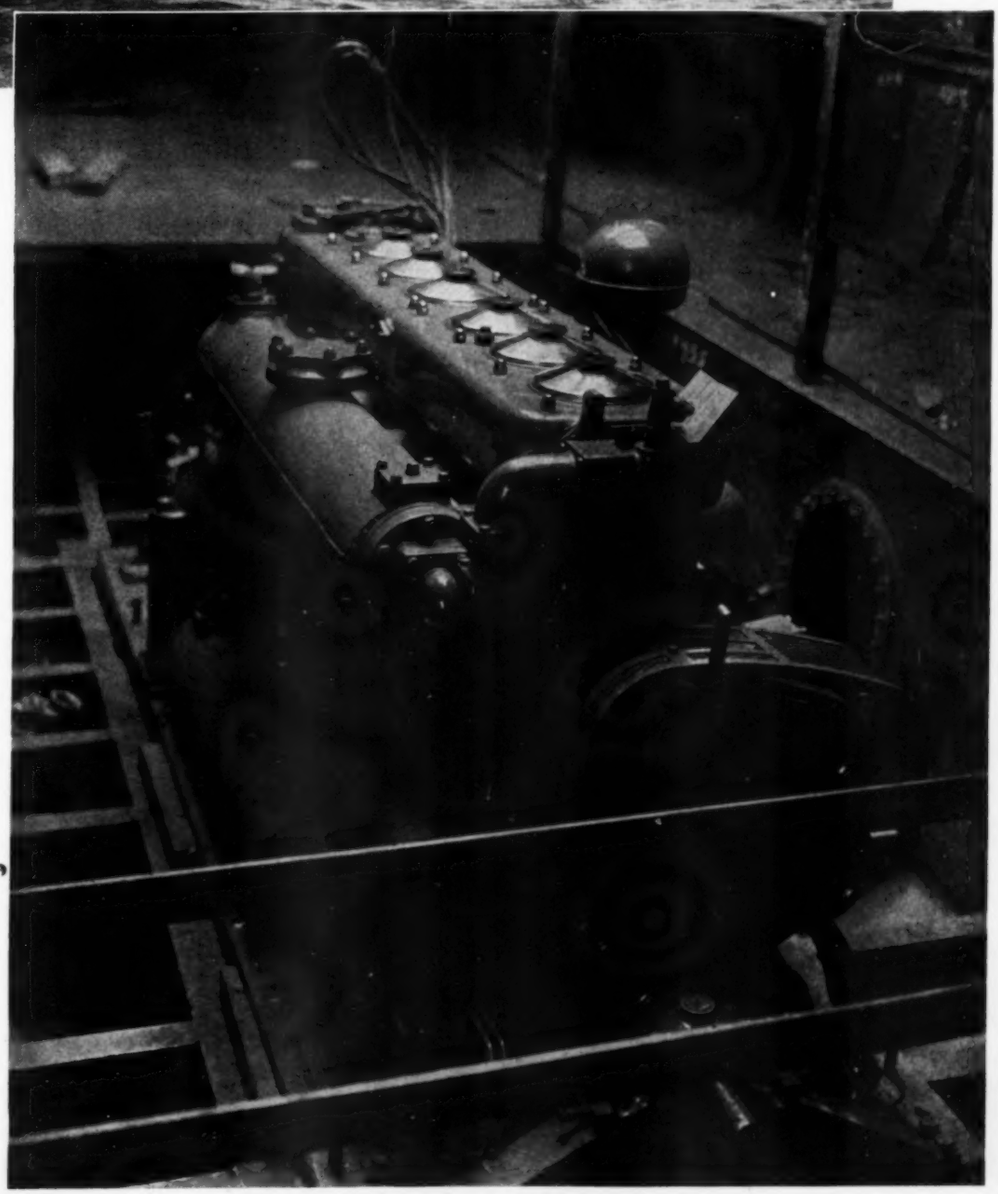
Mechanical Supt. W. P. Hartman has charge of all maintenance and operation of the Diesels, particularly shop work, and his two aides, H. V. Gill and H. D. Eddy, who head up the forces spread over the entire System.

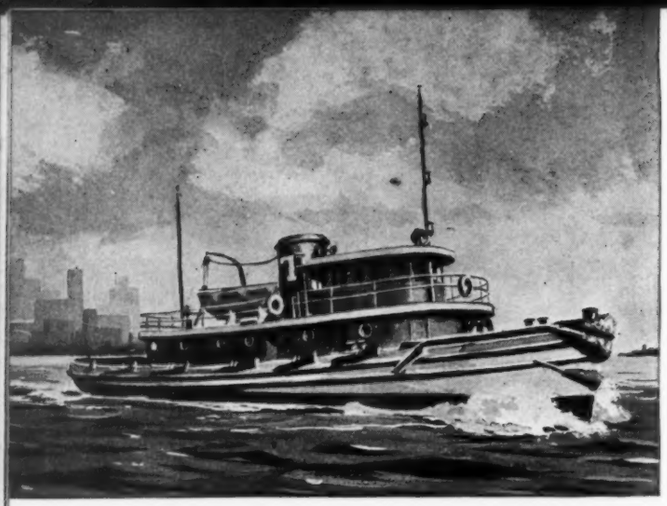
The two big Diesel shops are a story in themselves, and we will present a story on what now appears to be the largest and most complete Diesel locomotive shops operated by any railroad, possibly in our next issue. At that time the work of Messrs. Hartman, Gill and Eddy will emerge in detail, along with photographs and drawings to tell the story of how the Santa Fe keeps its Diesels groomed.



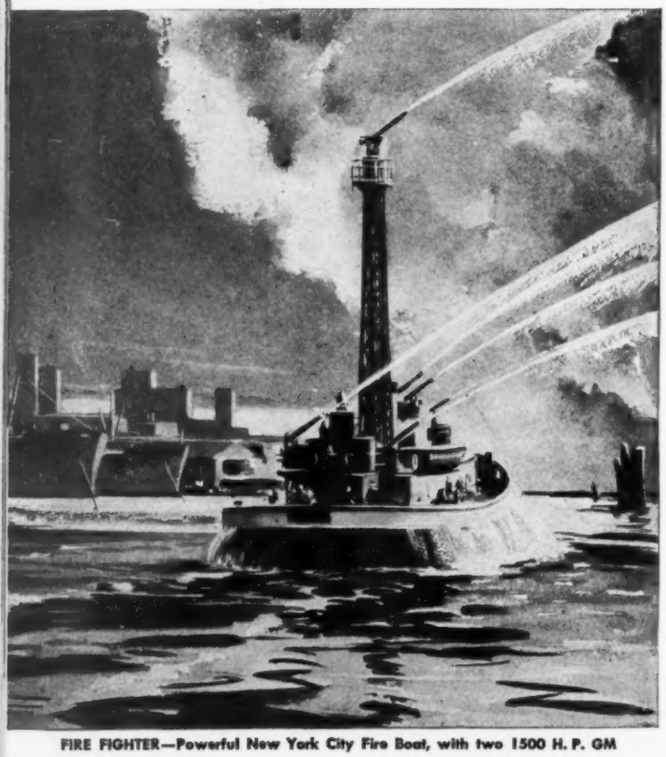
MODERN DIESEL LAKE FISHER

GREAT Lakes fishing tugs have been traditionally gasoline powered and wood construction, but the tide is turning to Diesel and steel as evidenced by the recent appearance of the very modern Diesel tug, *Lelond LaFond*. Built by the Kewaunee Shipbuilding and Engineering Corporation of Kewaunee, Wisconsin for Capt. Lelond LaFond of Milwaukee and put into service last October, her all steel, welded hull has an overall length of 52 ft. 4 in., beam, including fender of 15 ft. 7¼ in. and depth amidships of 6 ft. 9 in., distinguishing feature of which is a new type transom with rounded corners and a spacious engine room lined throughout with an acoustic material. The power plant, a Murphy six-cylinder Diesel rated 150 hp. for continuous duty at 1200 rpm., driving through a Twin Disc 3:1 reverse and reduction gear gives this vessel a free running speed of 12 mph. Such speed saves time on runs to and from the nets and gives the tug maneuverability so necessary to successful fishing in heavy weather. Yes, Great Lakes fishermen will soon learn the advantages of Diesel propulsion for their craft.





VENUS, 1930—Another veteran, with two 330 H. P. Winton *(now GM)* Diesels.

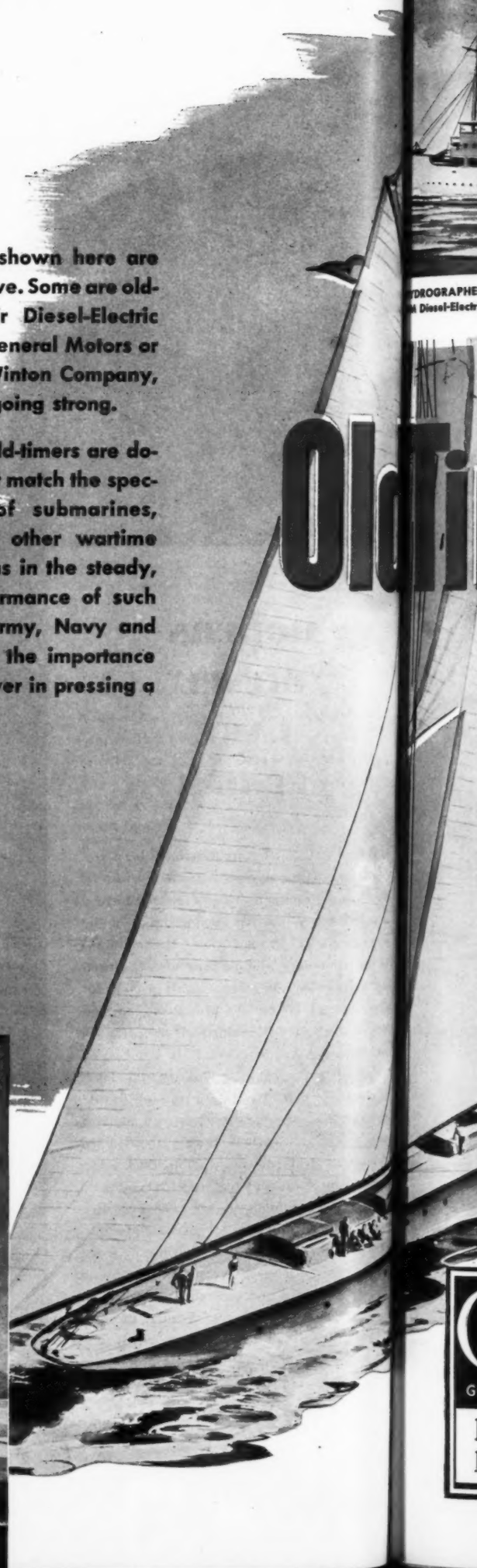


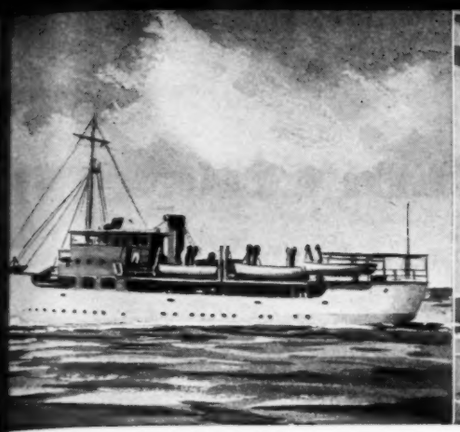
FIRE FIGHTER—Powerful New York City Fire Boat, with two 1500 H. P. GM Diesels.

U.S.S. SPERRY—Powerful 16,000-ton Navy submarine tender with 12,900 H.P. GM Diesel-Electric Drive.

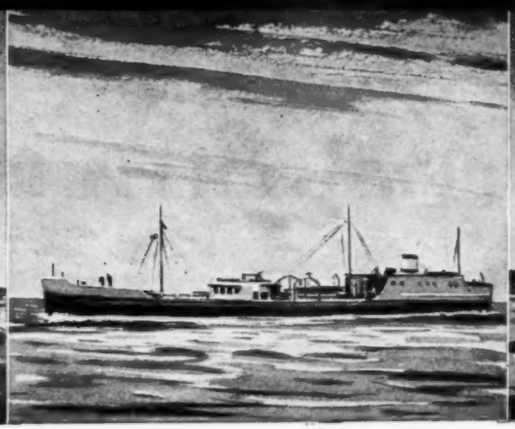
ALL the boats shown here are Diesel-Electric Drive. Some are old-timers. And their Diesel-Electric power, built by General Motors or its predecessor, Winton Company, is keeping them going strong.

The work these old-timers are doing today may not match the spectacular action of submarines, rescue tugs and other wartime vessels. But it was in the steady, outstanding performance of such boats that the Army, Navy and Coast Guard saw the importance of GM Diesel power in pressing a global war.





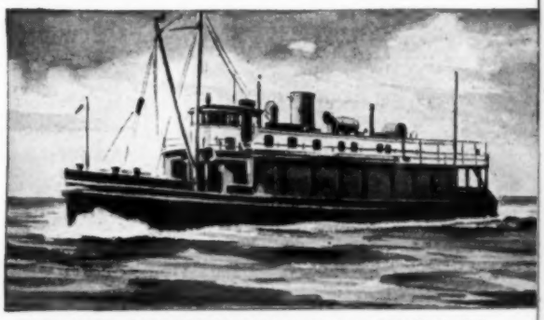
YDROGRAPHER, 1929—U. S. Survey Boat powered with
M Diesel-Electric Drive.



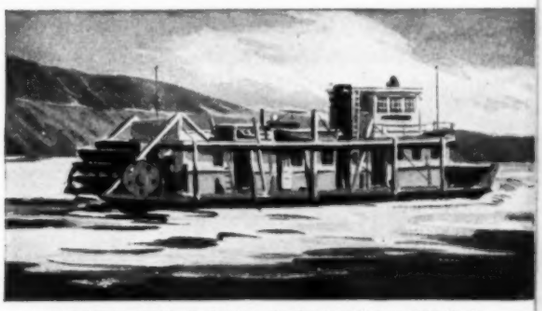
L. T. C. 3—Navy Tender, with two 325 H. P. GM Diesels.

COLUMBUS, 1926—Veteran Pennsylvania Railway towboat. Two 180 H. P. Winton *(now GM)* Diesel engines.

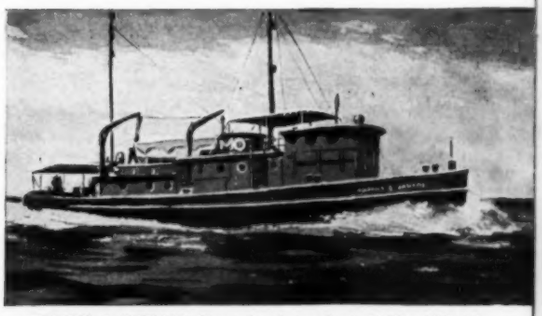
oldtimers still step along with the *New*



EDWARD F. FARRINGTON, 1930—with two 250 H. P. GM Diesels.



J. B. BATTLE, 1924—Early river towboat with two 150 H. P. GM Diesels.



WILLIAM J. MORAN—One of a large fleet of Diesel-Electric towboats owned by the Moran Transportation Company of New York City.

YACHT ELFAY, 1919—First boat powered with Winton *(now GM)* Diesel-Electric Drive.

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GENERAL MOTORS
DIESEL POWER

ENGINES *150 to 2000 H. P.* **CLEVELAND DIESEL ENGINE DIVISION,** *Cleveland 11, Ohio*

SINGLE ENGINES . . Up to 200 H. P.
MULTIPLE UNITS . . Up to 800 H. P. } *. . DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.*

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DIESELS PERMIT RATE REDUCTION AN PLA

By T. J. MALONE

TO remedy a condition of insufficient standby and be ready to serve greatly increased demands after the war, the municipal light plant in Sumner, Iowa, this spring is adding a new 1,000 hp. Diesel engine with 690 kw. alternator to its generating equipment and will remodel and enlarge its building to accommodate the expanded facilities.

In the face of an investment of about $92,000 in engine and new construction, the plant authorities did—what do you think? Increased consumer rates? By no means. They declared a general rate reduction, effective May 1, amounting to about 17 per cent. Expansion, better service and lower costs to customers go hand in hand at Sumner. Maybe there is a tip in this for other industries, public and private, in determining postwar programs.

This town of 1900 in northeastern Iowa knows what it is about. Its experience since 1935 with a municipally-owned, Diesel-electric plant has shown what it can do. The municipal plant replaced a high-line service that had been operating for about twenty years. It had succeeded a private steam plant.

The present plant had four Diesels operating on March 31, 1945, the end of its fiscal year, all supplied by Fairbanks, as was the new engine. Two Diesels of 210 hp. each and one of 140 hp., with auxiliaries, were installed at the outset. In 1939, a 375 hp. engine was added, raising the kilowatt capacity to 615.2. The new 1,000 hp. unit will replace the 140. When the change is made, the combined engine capacity will be 1,795 hp. and 1,215 kilowatts.

On March 31 last, the plant had paid off on its bond debt a total of $101,346 from earnings, as well as interest on that amount, and had $75,550 still to pay. It had current assets of $69,288, of which $26,100 was in United States war bonds. The total value of its investment in site, building, generating and other equipment, and distribution system was, without depreciation, $171,896.

None of its bonds is callable. In the nine years of operation, the plant has bought up $29,500 in bonds before their maturities by paying premiums to induce them to come in and be written off. The Board of Trustees is strong for retiring debt and saving interest. This accounts for its attitude toward so called "free services." There are few of them at Sumner, and those few of minor nature.

One type of free service is in connection with current supplied to the town for street lighting, water pumping, sewage disposal plant and lift station. This energy is billed at 1 cent a kilowatt hour, and any excess cost above that is absorbed by the plant itself. The excess has been running about $900 a year, lately. The board, in generous mood, canceled the April billings in 1941—but then came Pearl Harbor and it hasn't done the like since.

Eleven industries, along with a rural electric cooperative, are the principal users of power. There are two poultry processing plants, with freezing equipment; three feed mills, grinding and mixing poultry, dairy and hog feeds; a creamery, a box factory, a butter tub factory, a chemical company, a hatchery and an electric turkey brooder. The R.E.A. cooperative uses about 40 per cent of the total current generated, paying a wholesale rate.

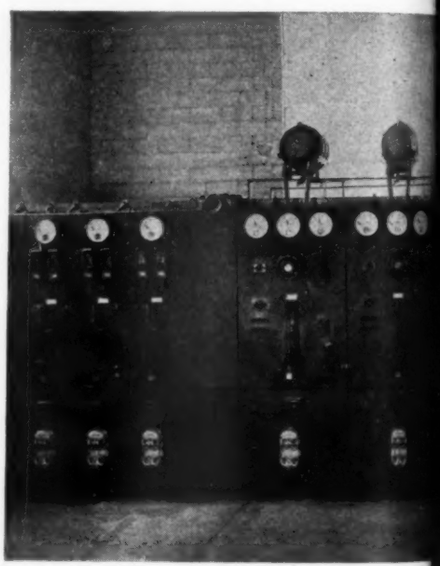
A listing of kilowatt-hour volume by fiscal years, each ended March 31 of the year named, and the production per gallon of fuel oil follows, together with average kwh. costs delivered to consumer and average kwh. sale price for the first full fiscal year of operation, the year next after installing the 375 hp. engine and the latest year:

Fiscal year	Total kwh. generated	Kwh. per gal. of fuel oil	Kwh. cost del. to consumer	Av. sale price
1937	798,318	11.513	$.01223	$.04204
1938	874,802	11.616		
1939	927,073	11.812		
1940	1,058,350	12.023		
1941	1,157,055	12.140	.01316	.04008
1942	1,256,400	12.169		
1943	1,630,295	12.363		
1944	2,263,480	12.347		
1945	2,196,552	12.194	.01250	.02879

These figures suggest how well the plant has been hitting the ball. The 17 per cent reduction in consumers' bills after May 1, as estimated, would make the average kilowatt-hour revenue $.0239 in eleven months of the 1945-46 fiscal year.

Peak load of the plant last year was 590 kw., against a rated kilowatt capacity of 615. Overloads had to be carried at times, and service to the REA cooperative was curtailed on several occasions by staggering hours or sections. The contract with the "coop" assigns it a 350 kw. peak; this will be raised when the new engine gets going.

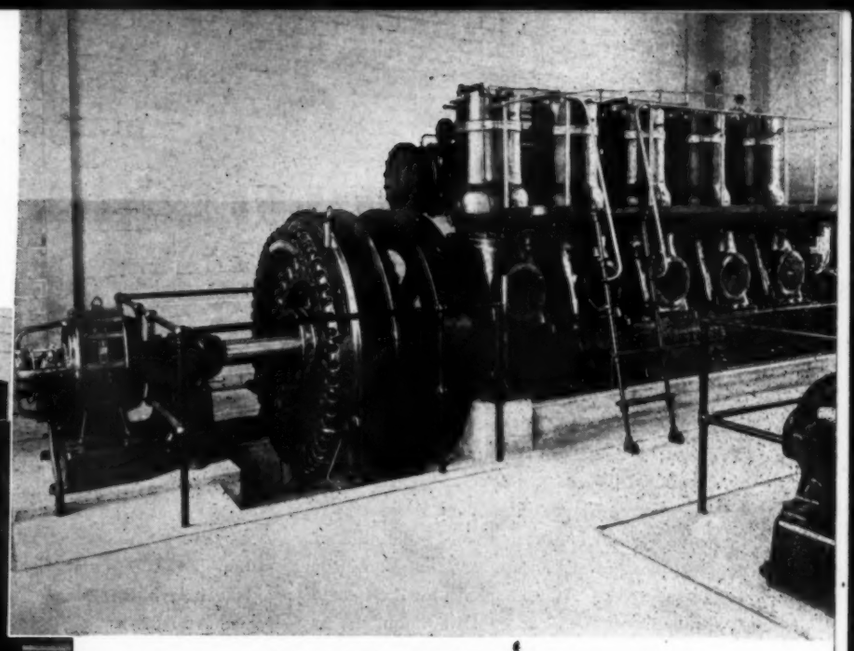
The new rate schedule keeps intact the bracket groupings in the various classifications, except for one change in the commercial lighting inclusive. The following table presents the monthly rates prevailing before May 1, 1945, headed "Before," and the current rates, headed with that date:



			Before	*May 1, 1945*
Residential lighting:				
First	50 kwh.	at	7c	6c
Next	50 kwh.	at	5c	3c
Excess		at	3c	2.5c
Commercial lighting:				
First	100 kwh.	at	6.5c	5.5c
Next	100 kwh.	at	6c	5c
Next	350 kwh.	at	5c	3c (next 300)
Excess		at	3c	2.5c
Commercial power:				
First	100 kwh.	at	6c	5c
Next	900 kwh.	at	4c	3c
Next	1000 kwh.	at	3c	2.5c
Excess		at	2c	2c

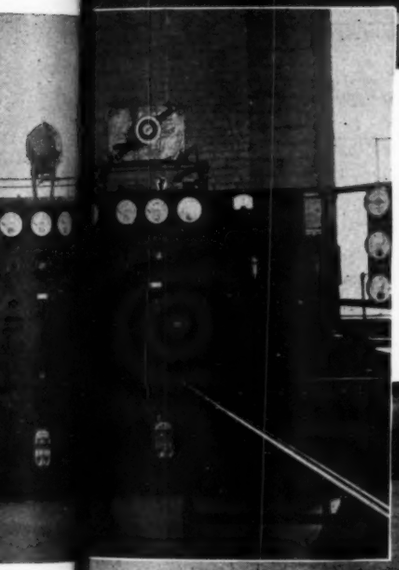
Rates in the "Before" column had been the same from the beginning of operation, except that in 1936 the "excess" in the commercial

AN PLANT EXPANSION



The new 1000 hp., 5-cylinder F-M Diesel and alternator installed in the Sumner plant this year.

Exterior view of the Sumner, Iowa plant.

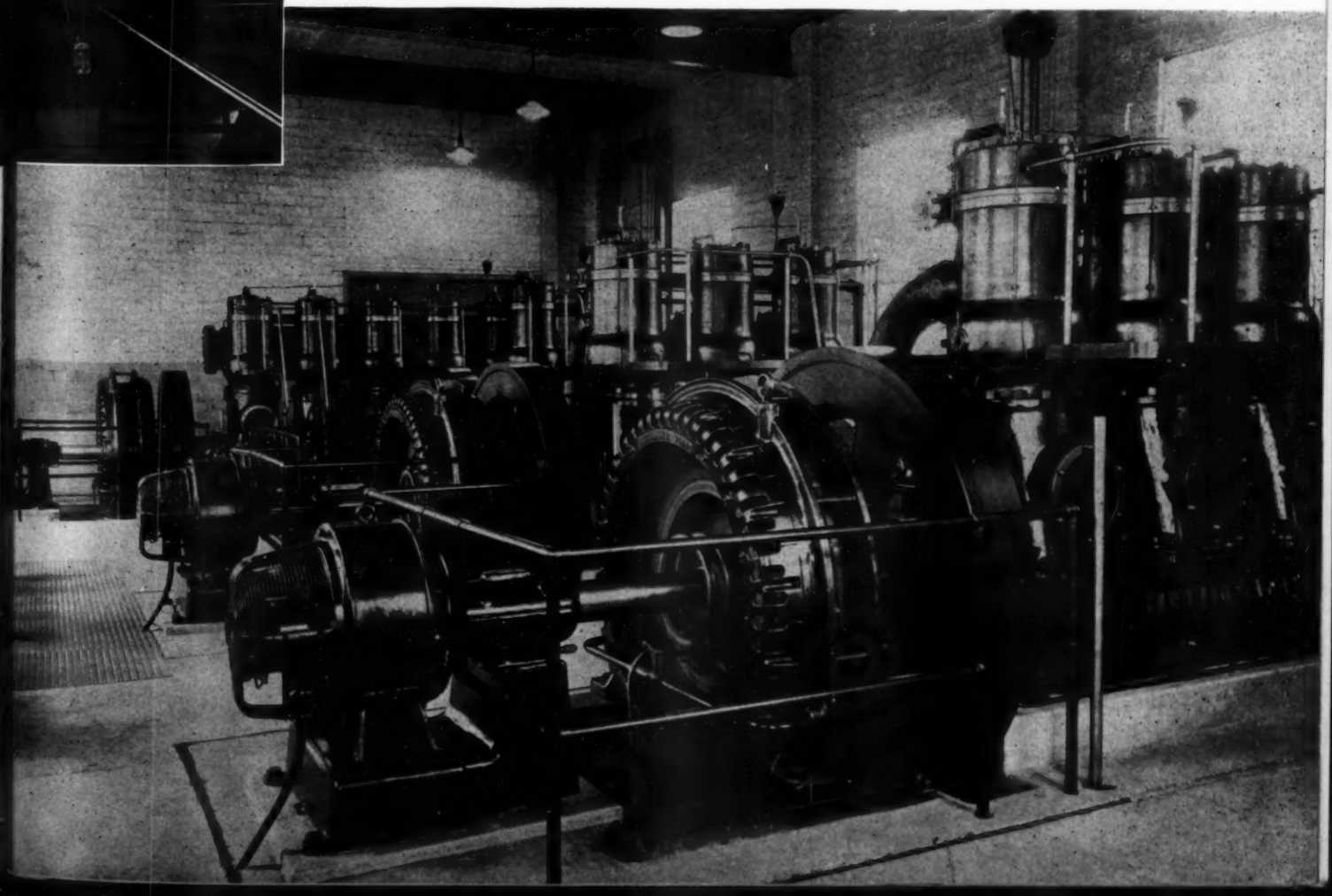


Modern dead front switchboard, fully equipped for four generating units.

power classification was reduced from 2.5 cents to 2 cents.

The Sumner plant, at first under control of the town council, has been under a three-member board since January 1, 1940. Members are H. M. Karsten, F. Ray Robinson and A. F. Miller. T. James Palmer has been superintendent of the plant from the beginning and is secretary of the board.

General engine room view showing four F-M Diesel generating units.



DUAL DIESELS DRIVE "RUBY VIII"

By JIM MEDFORD

ATTAINING a speed of 10.6 knots over a measured course in Elliott Bay, the 56-foot steel tug *Ruby VIII* is a powerful commercial vessel driven by dual high-speed Diesel engines through a single shaft. Built by the Reliable Welding Works, Olympia, Washington, from designs by H. C. Hansen, N. A., for the General Construction Co., Seattle, Washington, the tug is in use hauling supplies on Ruby Lake high in the Cascade Range for a dam project of the Seattle municipal power system.

Engines are two 6-cylinder Gray Marine Diesels, based on the Series 71 2-cycle Diesel engine built by the Detroit Diesel Engine Division of General Motors, each engine driving through a Twin Disc 3:1 reduction and reverse gear to a chain drive. Between the engines and the chain drive are flexible couplings.

Final reduction is 6:1, the single shaft turning a 60 in. x 52 in. wheel with a 20⅛ in. blade through a 4-7/16 in. steel shaft with rubber insert stern bearing. Each engine is equipped with a 32 volt generator and there are two sets of 32 volt batteries. With one engine clutched out, the single engine swings the five-foot wheel for a speed of 9.3 knots.

According to her designer, the installation is so planned that independent operation of either engine can be accomplished instantly. This leads to a number of advantages, typical of the modern trend. Aside from ability to drive the boat with one engine in case of engine trouble, foremost is the fact that no auxiliary engines are required for the extra equipment, leaving more space in the engine room, a real advantage in the average below deck space.

The engines are so arranged that the starboard engine delivers power to the fuel transfer pump and the single stage air compressor. The port engine operates the towing winch and a 4-inch scow pump. The tug can be operated through remote controls from the wheelhouse.

The trial run on Elliott Bay was interesting because every effort was made to test this type of engine hookup for vibration of either or both of the engines or the heavy towing type wheel. Over the entire two-mile course with the engines turning up their full 2,000 rpm., vibration was absent and temperatures well within safety range.

Observers on the trial run, in addition to Captain Ed Gunderson, included the designer, Naval Architect Hansen; Tom Orme, barging manager; S. O. "Ted" Jules, territorial representative of the Detroit Diesel Engine Division of General Motors; and A. E. Evans of Evans Engine & Equipment Co., who made the machinery installation.

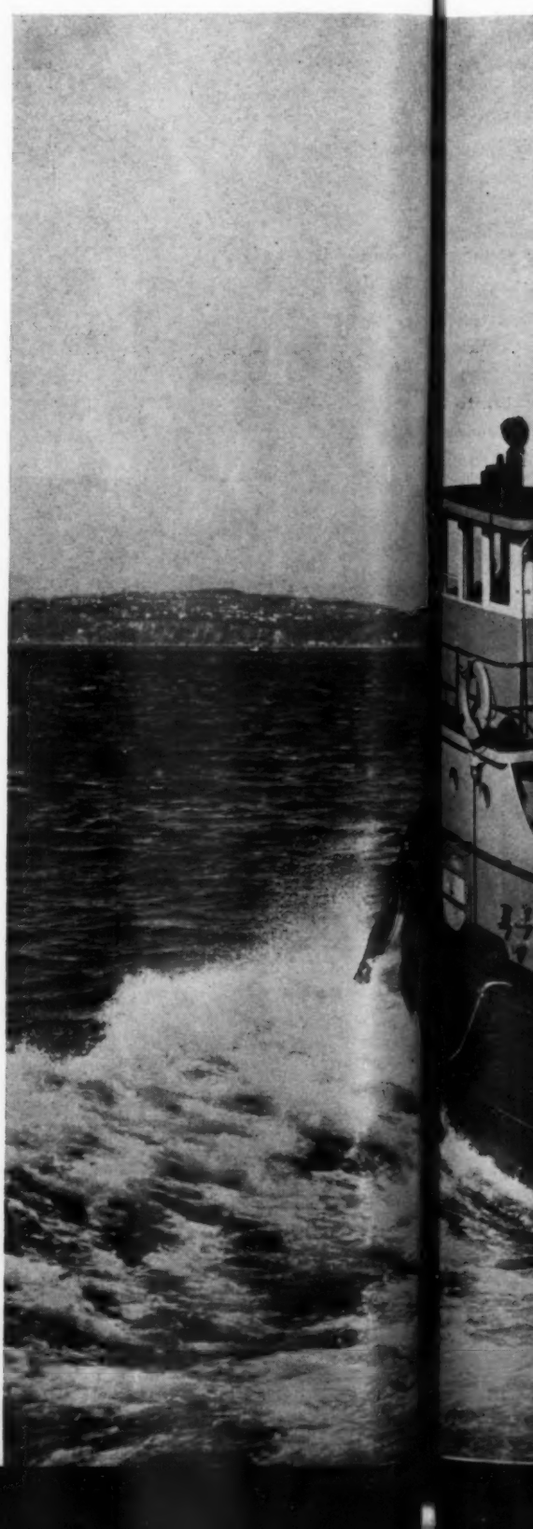
But with the completion of the run on Elliott Bay, plus a month of towing activity around Puget Sound, *Ruby VIII* picked up her foot and went overland. Because, you see, the vessel was built primarily for construction work on Ruby lake (hence her name) and this lake, created by the original Ruby Dam, is 572 feet above the water line on the dam's foot.

To make this transfer from one water level to the other, the tug was built for disassembling into sections by removing deck house and engines and loading the hull intact onto one flat car and the other two sections on another. The hull had to be accurately centered on its 80-foot car to pass through the Ballard Bridge where the clearance was actually less than *two inches* on the corners where the tracks enter the Bridge on a curve, and hauled to the railway terminus near the foot of a deep slope leading up to lake level.

Here the car was run sideways onto an inclined three-track, 45% incline and by aid of an electric hoist made the journey to the higher lake level. At the top the car was run into the water until the hull floated clear. Then the engines were installed and the job was completed with replacing of deck house.

From then on *Ruby VIII* was just another cog in the project of towing carloads of gravel and sand from the pit on opposite side of Ruby Lake to the dam face where the concrete was poured.

Installed equipment includes: Twin Disc gears; Purolator, AC and Engine Life filters; Burgess exhaust silencer; Exide batteries; Whitney chain in Gibson Mfg. Co., (Seattle) drive; Coolidge wheel; Delco starting equipment; Harrison heat exchangers.



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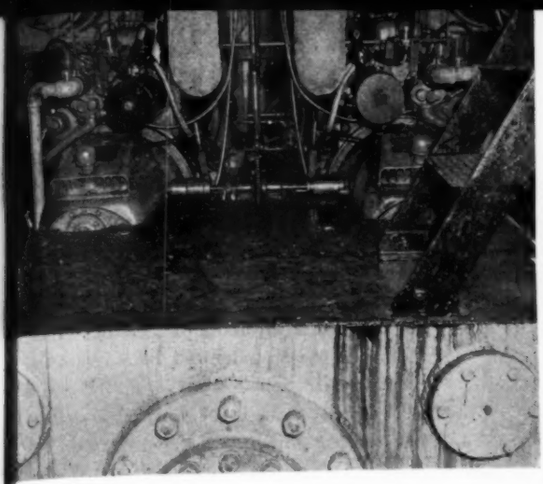
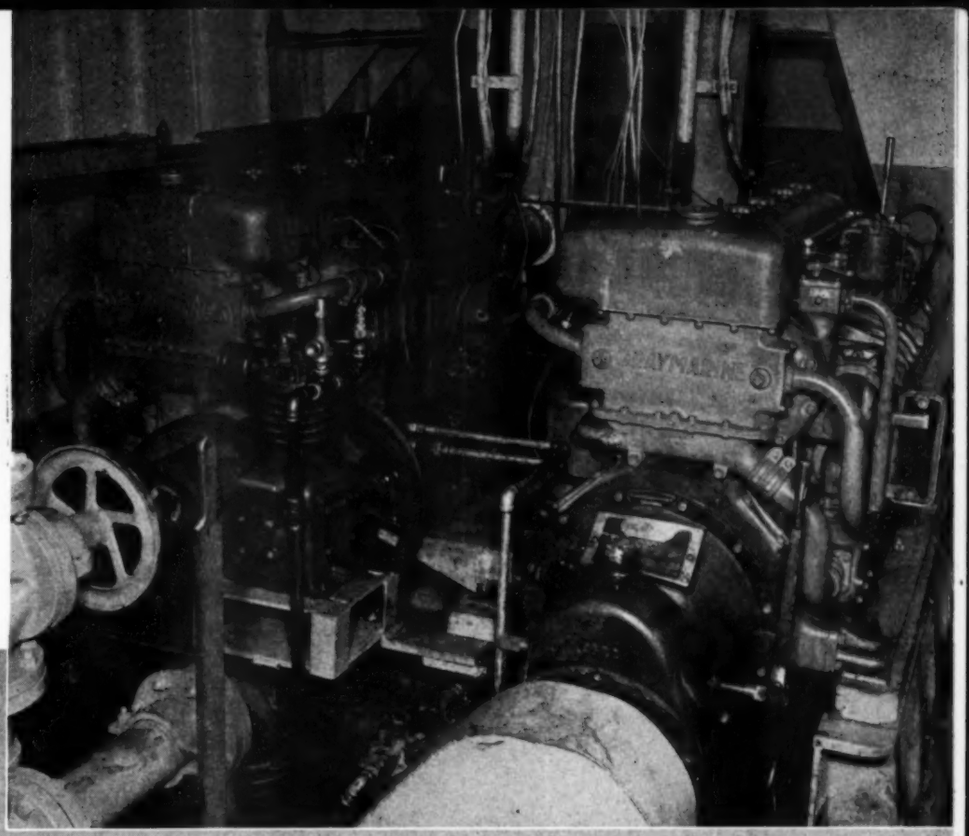
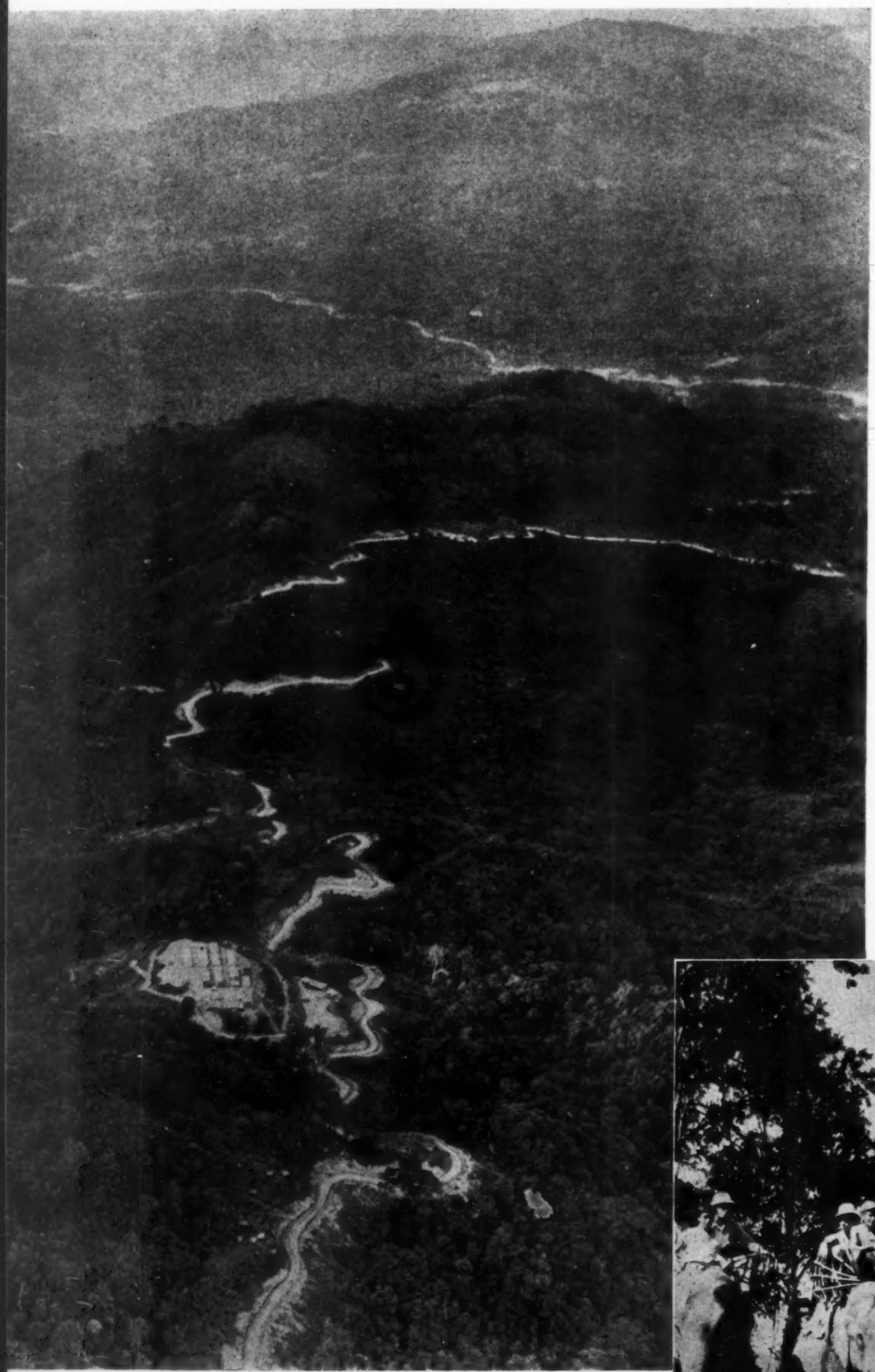




Above and right: Engine room views showing twin Graymarine engines, based on General Motors Series 71 2-cycle Diesels, with Twin Disc gears. Below: The "Ruby VIII" on trial run.

DIESELS AND INGENUITY BUILD THE ROAD THA*ould*



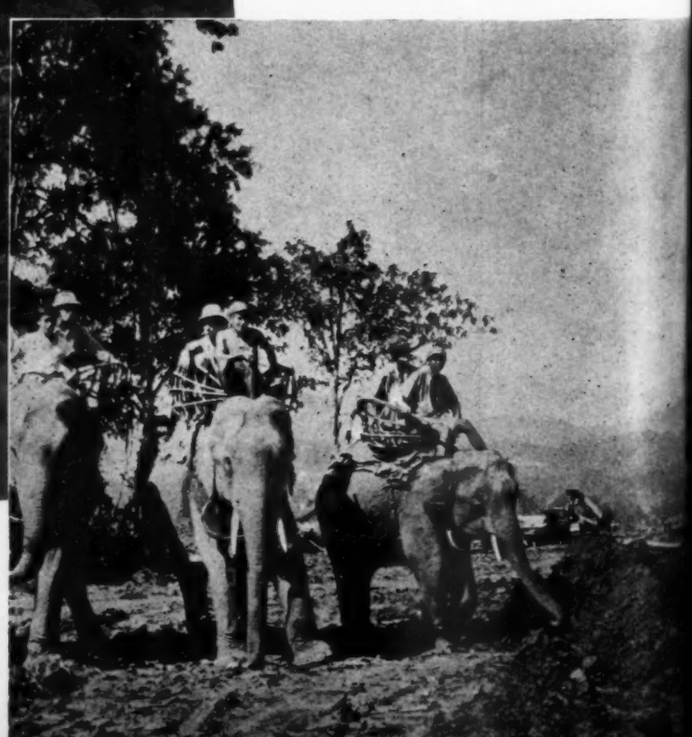
Now open to trucks with supplies for China the jungle route of the Ledo Road was first cleared of the enemy by Allied fighting men followed by U. S. Army Engineer construction work.

YANKEE ingenuity and Yankee machinery have again triumphed and the Ledo Road, running from Ledo, India to Kunming, China, a distance of 478 miles, has been completed. Officially opened January 25, 1945, the road is declared the greatest engineering accomplishment of World War II.

Back in 1941, Capt. Jas. A. Kehoe, who had been a Kentucky business man, landed in the Burma jungles to begin negotiations for building the road. With him, he took a quantity of cheap watches for trading with the Naja head hunters, and a bowie knife. His job was to locate military outposts and to survey the wild country through which the road was to pass.

It would have been discouraging to almost anyone who might have viewed the situation with prospects of building a military road so many miles through such insurmountable difficulties. But not to an Army engineer.

The survey followed, in many places, trails only a foot wide, left by the Burmese in their flight from the Japanese invaders. Great ledges dropped thousands of feet and many barriers were ahead that needed blasting by dynamite crews. British engineers had given up, after ten months of previous attempt at construction and with 42 miles completed, saying it was impossible.



Two Caterpillar Diesel tractors with La-Plant Choate and LeTourneau bulldozers at work on the Ledo Road in North Burma. Signal Corps Photos

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THAT Couldn't be Built!

By BENNETT B. SMITH

Camps were set up and the work began. There were only a few bulldozers, a number of old British trucks, some Chinese mules, and a quantity of untrained, native labor. Rains came in torrents and the road was soon a sea of mud with embankments washing out, and the whole a miserable loblolly. Often fuel had to be carried by native helpers for the tractors and, later during construction, was dropped from aeroplanes.

Leeches were in abundance, attacking workers in such quantities as to suck them of their blood until they were weak and ghostly pale. Sleeping was in water soaked tents and the workers were water soaked most of the time.

A short distance away Jap snipers were a constant menace and laborers, in addition to Army guards, had to be on the alert with rifles at all times to repulse any attack. No charts of this jungle, that had never before been crossed by white man, were available.

This was the situation when General Pick arrived in Ledo in October 1943 to take over the construction. He, too, met discouragement.

When asked by General Stillwell if a jeep road could be built by January 1, General Pick replied: "No, but we can build you a highway." He did it. The work was completed four days ahead of schedule—December 27. General Pick began operations 24 hours per day. Lighting was inadequate so torches were made by burning wicks in cans of Diesel fuel. He improved sanitary conditions and hot meals were provided 24 hours per day so that workers could eat at any time they found it convenient or might feel the need for food.

Many new trucks were secured and maintenance depots were set up so that repairs could be made rapidly and the work kept moving. Two lumber mills were established and these turned out more than a million feet of lumber and 2,400 pilings within thirty days.

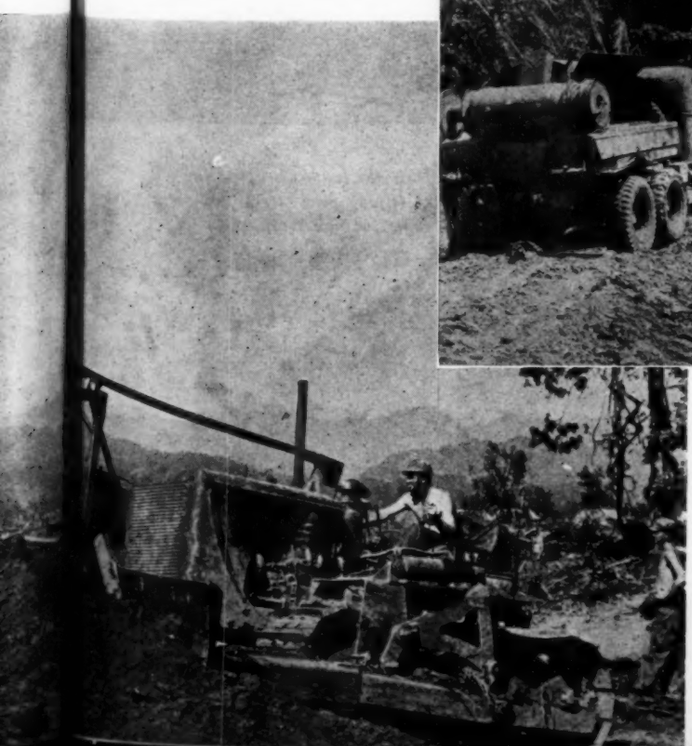
During construction, some 700 bridges were washed out during the torrential rains which averaged an inch a day and which, one day, reached seven inches. It became a drainage problem as well as road problem. But, no better officer could have been found for the job, as drainage was a specialty of General Pick. He had been division engineer in the Missouri river basin where he had constructed a series of dams and reservoirs to control the Missouri.

Thus, the battle went on 24 hours a day much of the time within the range of Jap bullets. Work was often washed out as fast as it was finished. Bulldozers often crashed over cliffs either by slipping, or being knocked over accidentally, and fell thousands of feet below.

Beginning at Assam State Railway at Ledo, the road crosses the Pagoda and Punkin mountains and follows the Hukawng, Mogaung, and Irrawaddy valley to Myitkgina. It then runs south to the river port town of Bhamo where it meets the north branch of the Burma road to Kunming, China. The road is not absolutely new for it was begun in 1920 along an old tea and spice route leading toward Burma. The road is the supply line for allied troops and serves as a link between India and the old Burma road to China which the Japs cut off soon after Pearl Harbor.

In a speech in New York, Brig. Gen. T. F. Farrell said: "The Ledo Road is our proof that the job hasn't been found that can lick American engineers and American construction equipment." General Stillwell, in reply to criticisms that the road was not worth the effort, replied that it had two objectives: 1. to get at least some supplies to blockaded China and, 2. to set up a situation in which Japs were killed.

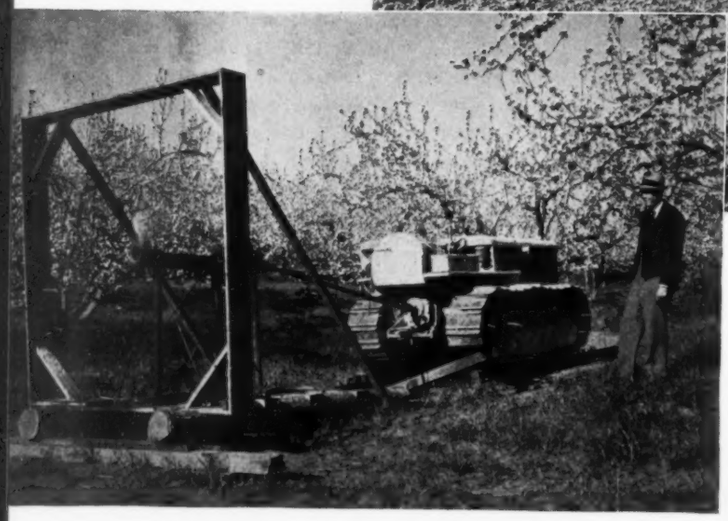
Soil of the road is of sandy loam which is soon a liquid muddy mass and which needs heavy surfacing to hold against the heavy traffic required of it. Rock of the vicinity is a shale-like material which soon grinds to fine powder and cannot be used for surfacing. Gravel from along the rivers was hauled and placed eight to twelve inches thick on the road. Width of the highway varies from 20 to 49 feet.



Left: Diesel tractors and trucks cut tops of ridges to fill gullies between. Below: Caterpillar Diesel tractor with LeTourneau bulldozer widening a section of the Ledo Road.

DIESELS HELP GROW FRUIT

Scene in Mt. Adams Orchards near White Salmon, Washington. Tractor is clearing land of old fruit trees. Tractors shown on this page are Caterpillar Diesels.



Diesel-made weather: here the tractor is driving a fan to draw cold air off fruit trees. Mt. Adams Orchards packs 100,000 boxes of winter pears and 500 tons of canning pears each year.

Here the tractor is uprooting old D'Anjou pear trees to make room for new trees.

Spraying Newton apple trees in the 12-acre apple orchard of Mt. Adams Orchards.

did you ever see DIRT before?

THIS is what it looks like, magnified 100 times. Sharp flint-like, often germ-laden.

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INSPECTION AND OVERHAULING OF DIESEL UNITS

PART III—CONCLUSION

Conducted by R. L. GREGORY*

IN the preceding two issues of DIESEL PROGRESS, the writer has attempted in a general way to outline the plan and procedure of carrying on a major inspection and overhaul job on a large Diesel unit. Space will not permit us to present the many varied minor details which present themselves in such a job, so they have been omitted. The thing that most Supervisors and Operators are interested in when doing such a job, is to obtain satisfactory results, with the shortest possible time being allotted for outage. In order to carry on the work with no overlapping of functions or false moves, the job must be well planned and executed.

The foregoing steps as outlined in the previous issues, having been completed and the unit reassembled, it is ready for a trial run with one exception. If you have any new auxiliary apparatus to install, or additions to make to present equipment, now is the time to complete such work. For an example Figure No. 1 shows a new crank case breather which was installed on a large unit upon completion of a major

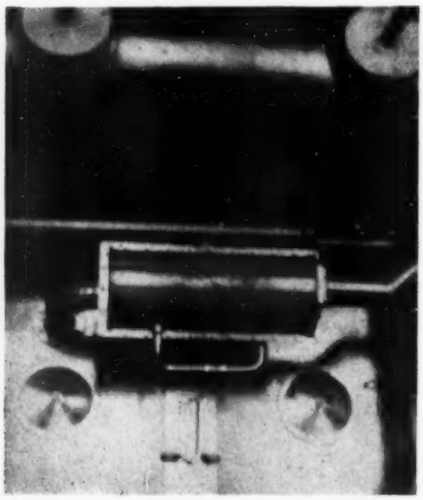


Fig. 1

overhaul. This breather as can be noted has the suction end connected to No. 2 inspection door and discharges into the scavenging header, with a "U" tube or drain running from the bottom of the breather and discharging back into the crankcase. At the same time this was installed a new continuous type of lube oil filter for filtering crankcase oil was also installed.

With this work completed, clearances checked, and the job completed, the unit was put into operation, running at no load for a couple of hours in order that all parts could be checked to see that they were functioning and to allow the lubricating system to get working properly, with air out of all lines, fuel valves and other parts properly functioning. Then the unit was cut into service at about one quarter load, and allowed to operate under this condition for several hours. The principal reason for carrying one quarter load being, to allow the rings to wear in, they being of the tapered type, .0025 in. wider at the bottom than the top, and also to allow for thorough lubrication. The load was then increased to one half load and operated for several more hours, from which point it was gradually increased to its normal load of about 80 per cent rating.

Indicator cards were taken on the unit at one quarter, half and three quarter loads as well as at no load after the unit had warmed up. These were checked for compression and maximum pressure and used as a basis of comparison in succeeding weeks of operation. It is always well to take weekly indicator cards and file them in rotation, as they will give you some indication of the operation of your unit. However that is a subject which we could dwell on for some time and will be discussed in future articles.

Now that the unit is back in service let us turn to the data that has been outlined and a summary of the same Figure 2, shows a typical stock card taken from the perpetual inventory which was mentioned in the first part of this discussion. Before the job was started the number of piston rings on hand was checked and it was found that there were 41 rings on hand.

With all cylinders requiring six rings each a total of 36 rings was needed, leaving a balance of 5 on hand. When these rings were taken from stock, this dispersal was recorded on the stock card and immediately 48 new rings were ordered, which arrived on June 15th and were entered on the stock sheet, the inventory now showing 53 rings on hand and available for use when needed. When the 36 were withdrawn from stock the cost which amounted to $261.00 was entered upon the material sheet, Fig. 3 as shown and charged against the job number A-100-1 which was alloted to this overhaul job. All succeeding withdrawals from stock were handled in like manner and upon completion of the job, the sheet shown in Fig. 3 gave the cost of materials used on the job.

. . . . *And now please turn to page 90* . . . .

Fig. 2

CARD NO. 20 UNIT NO. # 1. MANUFACTURING NO.

COMMODITY Tapered Piston Rings LOCATION Gallery WT. PER FT. MAXIMUM

SIZE AND DESCRIPTION 21.005" # 182 M-178-2 UNIT PCS. PER LB. MINIMUM

DATE	FROM OR TO	UNIT COST	RECEIVED	QUANTITY BALANCE	ISSUED	DATE	BALANCE	TOTAL COST	RECEIVED	QUANTITY BALANCE	ISSUED
							Balance				
3-1-45		7.25		41			$ 297.25				
5-28-45		7.25		5	36		36.25	261.00 - Job No.A-100-1			
6-15-45		7.25	48	53			384.25				

Fig. 3

POWER PLANT JOB TICKET Job No. A-100-1

May 1945

Labor and Supervision On Inspection and Overhauling Of Number 1 Diesel.

Deisel ☒ Steam ☐ Account 457.

MATERIAL		LABOR			REGULAR		OVERTIME	
REQUISITION NO.	DATE	EMPLOYEE	NO.	AMOUNT	NO.	AMOUNT		
Maintenance	May 45	J.K.Wilson	80	80.00				
"	" "	G.Jones	80	80.00				
"	" "	Tom Brown	80	80.00				
"	" "	Bill Smith	88	88.00	7	9.00		
"	" "	Jack Williams	88	88.00	7	9.00		
Foreman	" "	Fred Johnson	90	112.50	10	18.75		
Supervisor	" "	T.W.Russell		150.00				
		Total regular		678.50			36.75	
		Total Overtime		36.75				
		Total Labor		$ 715.25				

Fig. 4

DUPLICATE

BOARD OF PUBLIC WORKS

POWER PLANT REQUISITION

No. 225 Job No. A-100-1

Date May-31-1945

Deisel ☒ Steam ☐ George Brown FOREMAN

QUAN	DESCRIPTION	AMOUNT
36	Tapered piston rings 21.005" part # 182 @ 7.25	261. 00
4	Fuel Check Valves, part 603 @ 6.50	26. 00
4	Fuel Valve Springs, part 604 @ .15	60
6	Sets of Needle Valve packing 3/4" x 1-3/8" x 1-1/2" @ .75	3. 00
5	Check valves, part 64458 @.50	2. 50
1	Power Piston Head , part # 181 @ 240.00	240. 00
1	Scavenging Valve, part 386 @ 1.75	1. 75
4	Lead gaskets, part 548 @ .40	1. 60
1	Special Stud, part # 188, @ 3.00	3. 00
	ETC.	
	Total material Cost.	539. 45

* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

COMMUTATOR MAINTENANCE

By C. B. HATHAWAY*

(Continued from August issue)

THE sparks occurring at the brush result when the current is reversed in a coil as the bars, to which its leads are attached, pass under the brush. The time of this reversal is extremely short and therefore high reactance voltages are set up. To overcome the adverse effects of these high voltages, a commutating pole or interpole is frequently used to set up a voltage from the coil in which the current is being reversed to counteract this reactance voltage. If it were possible to completely compensate for this reactance voltage no sparking would occur at the brushes, providing the commutator is smooth and the brushes ride evenly.

Occasionally every third bar around the commutator shows smut while the two bars in between have a normal color. This can happen where there are three bars per slot. In the case where there are four bars per slot every fourth bar is sometimes found blackened. This is due to improper strength of the commutating field or improper shape of the face of the commutating pole.

The commutating condition for each of the three conductors in the slot are different. The energy set up by the reversing of the current in coil "A" in Figure 2 is partially transferred to the coil "B" by mutual inductance. When coil "B" starts its commutation it has a chance of unloading part of its energy to coil "C," but when coil "C" is commutated there is no place to deliver its energy, therefore it is more likely to deliver it as an impulse through the brushes. This impulse, of course, may show up as a spark or an arc of very short duration.

Since the commutating condition in the three coils is different the commutating pole design can only be made to take care of the average condition and the inherent energy absorbing capacity of the brushes must be relied upon to take up the difference between the average and the peak values of voltage. If the strength of the interpole is not adjusted for this average the strength of the peak energy is apt to be greater than can be absorbed by the brush. Obviously, this peak will be excessively strong in only one coil of the group in the slot. Such a condition can be eliminated by correcting the strength of the interpole flux.

An inherent characteristic of carbon brushes that ride upon a moving commutator is the drop of one volt between the face of the brush and the surface of the commutator. This voltage drop varies slightly with current, but for all practical purposes it may be considered as one volt. Some brushes have much higher contact drop than this while others, such as the copper-graphite brushes, have much lower contact drop; but these will not be considered here as they are used in very special applications. As mentioned before, this one volt drop provides a cushion to absorb the energy set up by the armature coils being commutated that is not fully neutralized by the commutating poles.

The density of the current in the brushes does not follow a hard and fast rule. Modern electrographitic brushes will operate satisfactorily with densities up to 65 amperes per square inch continuously. However, accepted practice holds this density to between 40 and 50 amperes per square inch. Many cases have arisen where responsibility for poor commutation is blamed on high density and additional brushes have been insisted upon. There is no evidence to support the contention that an increased number of brushes, when applied only for the sake of reducing the current density, has been beneficial. Additional brushes may however improve the mechanical contact problem and thereby be beneficial. For example: if a motor has but two brush arms with only one brush per arm, a great improvement can be obtained by adding one or two more brushes per arm (See Figure 3) because it isn't likely that all the brushes with the same polarity will be off the commutator at the same instant. This does happen however, in the case of one brush per polarity.

The question of the proper hardness of brush arises frequently. The softer brushes are more likely to result in better commutation. This is thought to be due to the fact that they wear away more rapidly and present a fresh face to the commutator and therefore maintain a higher contact drop. However, soft brushes have two distinct disadvantages; one is that they

. . . . *And now please turn to page 92* . . . .

* *Manager, D.C. Motor Engineering Department, Westinghouse Electric Corp.*

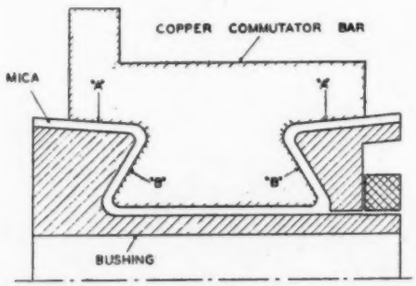


FIGURE 1

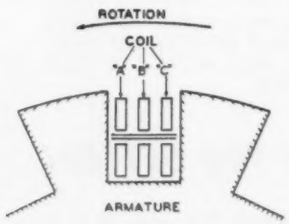
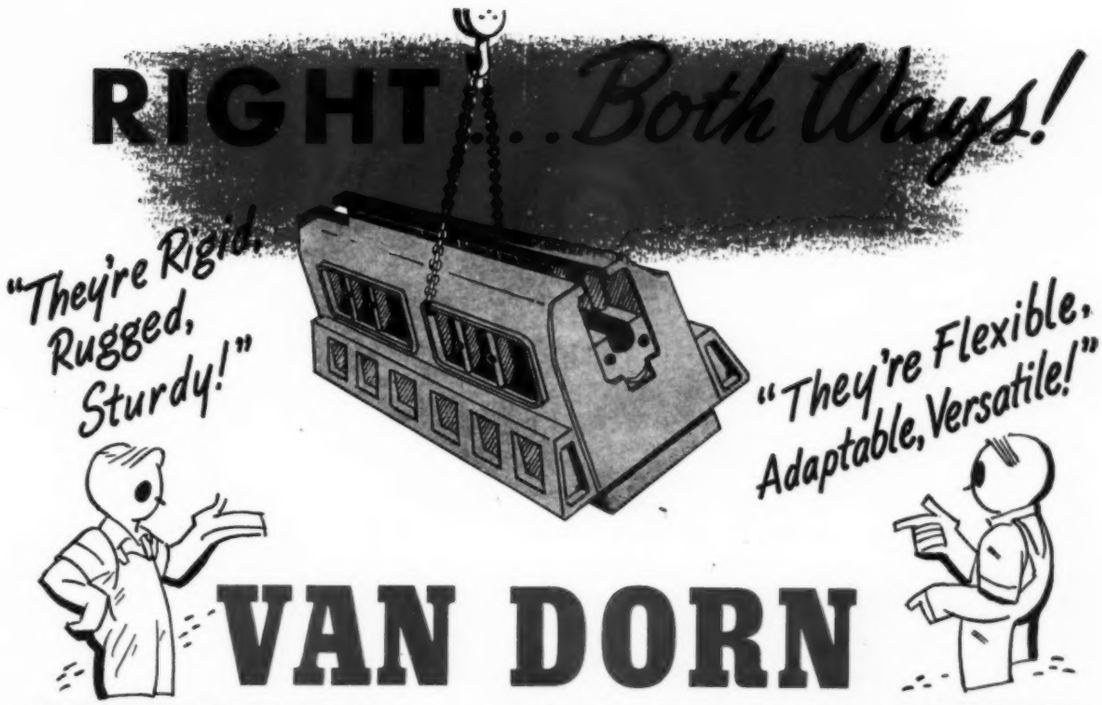


FIGURE 2

RIGHT...Both Ways!



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THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

Oil Reserves

. . . . *Continued from page 55* . . . .

The conversion is a relatively simple matter An oil tank replaces the coal space in the tender, and an oil burner is installed in the grate area.

In the Diesel engine the energy in the oil is not used to make steam, but to turn an electric generator which supplies the current to operate electric motors attached to the driving wheels of the locomotive. Hence the name "Diesel-Electric" locomotive.

In a Diesel engine the energy in the oil is liberated by burning a mixture of oil and air in cylinders under the pressure of the pistons. In an automobile engine, as all know, an electric spark ignites the mixture of gasoline and air.

From an engineering viewpoint, a Diesel-Electric locomotive is far more efficient than a steam locomotive. In a steam locomotive only 7% of the energy in the coal is available for useful work, whereas in Diesel-Electric locomotives the efficiency can be as high as 25 per cent. These differences, however, tend to be ironed out by the higher price of oil. If, for example, Diesel fuel is selling at 6 cents a gallon and coal at $3.00 a ton there is no advantage in favor of the Diesel as far as fuel cost alone is concerned. In fact, at times the fuel costs of Diesel operation are more than the fuel costs in operating coal-burning locomotives.

Why, then, are more and more Diesel-Electric locomotives going into use? The first Diesel-Electric passenger locomotive appeared only 11 years ago. Today there are over 4,000 Diesel-Electric locomotives, and the trend is definitely upward.

The answer is that fuel cost is only one of many factors in railroad operating costs which are affected by the type of motive power used. Diesels can make longer hauls without stopping for fuel or servicing which means that one locomotive can haul more freight or passengers. Diesel engines use almost no water, and the cost of facilities for treating water to protect steam locomotive boilers is a considerable one. The greatest savings come when a railroad is completely Dieselized, in which case large economies can be effected by scrapping coaling stations and other expensive facilities needed for the maintenance of steam locomotives.

. . . . *And now please turn to page 90* . . . .

Aireon is now developing complete remote controls for the 13 x 16, 6 cylinder 400 HP Atlas Imperial Marine Diesel Engine shown here. Following laboratory and service tests a complete line of remote controls for this engine will be available.

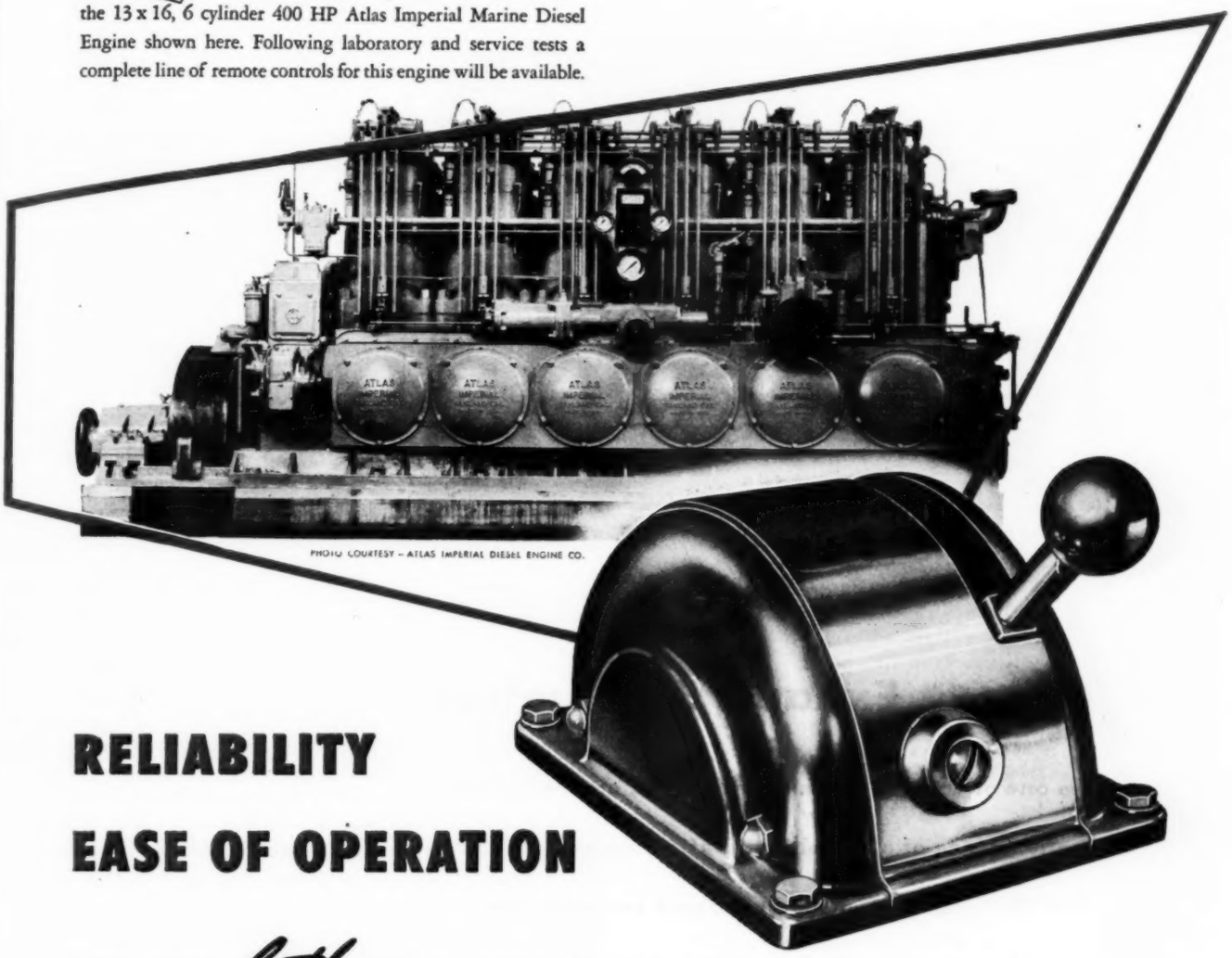

PHOTO COURTESY – ATLAS IMPERIAL DIESEL ENGINE CO.

RELIABILITY
EASE OF OPERATION

YOU GET *both* WITH AIREON HYDRAULIC REMOTE CONTROLS

Whether it be controls for the throttle, fuel pressure regulator, engine governor, transmission, sailing clutch or direct reversible diesel engine... Aireon has them! They may be used for any type of industrial application calling for remote controls. Why not put your individual control problem (either industrial or marine) up to our Engineering Staff? Address:

Aireon

MANUFACTURING CORPORATION

HYDRAULIC CONTROLS DIVISION • 100 WEST OLIVE AVENUE • BURBANK, CALIFORNIA

Oil Reserves— *Continued from page 84*

Only by a most careful study of such factors as these and many others, can a railroad decide whether it will be profitable to use Diesel instead of steam power. Since the factors that will influence the choice vary greatly on different railroads, we may feel reasonably sure that both steam and Diesel-Electric locomotives will be hauling the coal and oil and other freight of America for many years to come.

Supervising: *Continued from page 80*

Figure 4 was a summary of the time and cost of the Maintenance crew and Supervisory personnel, it being the summary of the man hours worked on this job and charged to job number A-100-1, the same as the material charge. The totals of the material and labor cards, thus gives you the cost of this particular overhaul job, which is accurate and can be filed for future reference. However one other item enters into the picture when using this as a basis cost for future overhauls. An accurate record of the condition of the unit as found must be kept for comparison with the condition as found at the next overhauling period. Otherwise when the next major overhaul is carried on the unit may be found to be either in better or worse condition than it was in this particular instance, consequently the time and man hours as well as the material needed will vary in proportion to the condition of the unit. Therefore these items must be taken into consideration in comparing the cost of one overhaul job as against another.

A nice method of keeping such records is to obtain a loose leaf note book and index each year's costs, condition and results as they are carried on. It supplies the Supervisor with some interesting data on his Units as the years roll by. Now some Supervisors and Engineers may feel that is is a lot of unnecessary work, but if it is worth doing at all, it is worth doing well, and a few hours spent in figuring up costs, laying plans, and recording conditions and results, will certainly pay dividends in the long run.

DIESEL PROGRESS
Editorial Index

A COMPLETE index of all editorial material which appeared in the 1944 issue of DIESEL PROGRESS is now available. Included is a cross index of authors and articles. Feature articles are covered by title; news notes are indexed by names of manufacturers. No charge for this index. Address requests to DIESEL PROGRESS, 2 West 45th Street, New York, 19.

Exchange Ideas:

Continued from page 82

wear away more rapidly; and the other is that they are more easily chipped or broken where there is any vibration or pounding present. It is imperative to use hard brushes on applications where there is any considerable amount of vibration, such as a motor driving a load through spur gears. Gears introduce a high-pitched vibration into the motor armature which results in chattering of the brushes. Soft brushes will break up under this chattering and are unsatisfactory. The hard brush, however, does not wear away as rapidly as the soft brush and therefore develops a glaze on the face that is not particularly conducive to good commutation.

The invention of the double brush holder has resulted in a marked improvement in commutation (see Figure 3). This brush holder increases the likelihood of more brushes being in contact with the commutator at any instant and also provides a longer path through which the short-circuited currents of the armature coils undergoing commutation must travel.

The importance of having several brushes per polarity cannot be over-emphasized. Motors of 5 hp. or larger should have at least two brushes per polarity. If one brush is knocked off the commutator the other one is in contact and carries the current. If all the brushes of one polarity are jarred from the commutator there is certain to be an arc formed between the brush and the face of the commutator in order to carry the current.

This problem is particularly true on machines that have but two brush arms, or one brush arm for each polarity. The motor having but two brush arms cannot possibly commutate as well as one having four arms. With two brush arms all of the brushes for one polarity are in contact with the same bars in the commutator. The chances of them being disturbed simultaneously are very great. This should not be taken to mean that it is impossible to operate motors with only two brush arms. The necessary crowding sometimes found in certain types of machinery makes it highly desirable to use but two brush arms. However, the fact still remains that the machine would operate better from the standpoint of commutation if it had four brush arms, or two per polarity.

It is quite easy to replace an old brush with a new one and walk away from it and let it wear itself so that its face has a contour agreeing with that of the commutator. This is particularly true if several brushes are being replaced simultaneously and especially so if they are all being replaced. Sparking with its resultant burning of the commutator is sure to occur if unfitted brushes are applied to the machine. The brushes should be sanded to the contour of the commutator by first grinding the face of the brush with rough sandpaper placed between the commutator and the brush as shown in Figure 3. The sandpaper should be pulled in the direction of rotation. At the same time it should be held firmly against the face of the commutator. The return stroke should be made with the brush lifted from the surface of the sandpaper. After the rough grinding has been finished and the brush has the general shape of the surface of the commutator, the remainder of the grinding should be done with fine sandpaper. While it is permissible to apply additional pressure to the top of the brush during the rough grinding only the pressure of the brush finger should be used during the finish sanding.

It is impossible to grind in brushes so they

. . . . *And now please turn to page 96* . . . .

A three word description of the STERLING *Viking Diesel*

COMPACT

RUGGED

DEPENDABLE

THE Sterling Viking Diesel is as *compact* as a gasoline engine of the same power rating—yet it offers all the advantages of diesel fuel. Its *rugged* construction enables it to take heavy duty punishment—for into it has been built the stamina to give long years of *dependable*, trouble-free, economical service.

Some of its outstanding engineering features are: lower weight per horsepower; reduced fuel consumption per brake horsepower; greater thermal efficiency; higher rotative speed without excessive piston speed.

The new Sterling Viking Diesels—six or eight cylinder, supercharged and unsupercharged—as well as the complete line of Sterling gasoline and gas engines are fully described in these new booklets, "Dependable Power" and "Marine Power". Everyone interested in selecting a new power plant for marine or industrial use will want a copy. Write for yours without obligation.

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STERLING ENGINES...MARINE AND STATIONARY...FROM 68 TO 1800 HORSEPOWER...GASOLINE, GAS AND DIESEL FUELS...ARE AVAILABLE NOW

Exchange: *Continued from page 92*

will have a polished face before the machine is operated. However, a simple check can be made to determine whether the brush has been ground in satisfactorily. When it appears that the brush has been ground in properly, the machine should be operated for one or two minutes and then shut down. If upon observation of the face of the brush polished streaks are apparent between the trailing and leading edges, and these streaks form a uniform pattern all the way across the width of the brush face, a proper job has been done and the machine can be operated without fear of trouble so far as this grinding-in operation is concerned.

There are a number of problems that must be faced relative to the operation of motors. One is the riding of the brushes on the commutator. Commutators are never perfectly round. Even when new the manufacturer allows a tolerance of about .001 in. eccentricity. If the machine has operated for a time the eccentricity combined with other irregularities, may reach .002 in. or .003 in. Carbon brushes have a resiliency that makes them particularly well suited to follow these irregularities. They must absorb the movement of the commutator face to a degree without moving the entire brush to the same degree. The brush acts as a sort of a spring so that it contracts and expands itself in following the irregularities of the commutator. Some of this motion of course reaches the pressure finger and results in a slight motion up and down.

The chocolate brown color so highly desired on the face of the commutator is in reality an ozide film which has been layed down by the brushes. The presence of this film helps to reduce the friction between the commutator and the brushes. However, conditions arise sometimes when this film is irregular and uneven. This results when the brush density is less than about 5 amperes per square inch and may be encountered when a machine operates for a considerable period of time without load. The effect of this irregular film is to make the brushes chatter. Sparking and consequent burning may occur and the brushes may chip and break up. Regardless, operating conditions may make it necessary for a machine to run at light load for considerable periods of time. To insure a satisfactory film under such conditions select a brush that has a slight abrasive in it. This will permit a proper film to be deposited on the commutator, yet there will be sufficient scouring action to keep it smooth and even.

The presence of uneven film on a commutator can be detected by feeling the brush as it rides the commutator. If it feels rough, sandpaper the commutator as this removes the film entirely. If it feels smooth after sanding the evidence is conclusive that it was irregular film that caused the vibration of the brushes. If, however, the sanding operation did not result in a change of vibration of the brushes then the conclusion can be drawn that such vibration was not due to film but to irregularity in the surface of the commutator.

Frequent sanding and grinding of the commutator should be avoided if at all possible. Sanding a commutator is not too harmful, but grinding with a hand stone is particularly injurious because this action actually cuts away small particles of copper. These particles of copper can be, and some always are, drawn into the windings of the armature where they can cause shorts and grounds. This danger is particularly great in machines that have open risers between the bars and the ends of the

. . . . *And now please turn to page 98* . . . .

Exchange: *Continued from page 96*

armature coils. It has been the experience of many users that armatures fail soon after hand stoning.

Brush potential curves are a very useful means of determining whether the interpole strength is proper for best results. To obtain values for such a curve it is necessary to use a high resistance voltmeter with a range of about 3 volts. The readings taken are of the voltage drop between the brushes and the commutator. To obtain these one terminal of the voltmeter is attached to the brush rigging and the other to a pointer which must be insulated to permit holding it in the hand. This pointer is gently applied to the rotating commutator, first at a point near the leading edge of the brush where it contacts a bar. A reading is taken. This is point number one on the curve. The pointer is then moved to the center of the brush and a reading taken. This is point number two. A third reading is taken near the trailing edge of the brush and is recorded as point number three. Regardless of the direction of rotation the curve is plotted with point number one to the left and point number three to the right. If the commutating pole strength is too great the curve will slope downward from point one to point three. If the machine is undercompensated then the curve will slope upward from point one to point three. The most desirable curve is one that has a slight downward slope from number one to number three.

Occasionally turns of a commutating coil are removed if the lead happens to be burned off. For example, if the lead is off a coil that has 24 turns, one turn may be unwound in order to provide a new lead. This should not be done for the reason that the removal of one turn in the coil very materially alters its commutating effectiveness. Approximately eighty per cent of the turns on the coil are necessary to suppress the armature mmf before any effect is made by the coil on commutation. Only the last twenty per cent of the turns on the coil are effective in aiding commutation. When the coil has but twenty-four turns, only about five are effective for correcting commutation. If one turn is removed it changes the effectiveness of the coil twenty per cent. Therefore, it is obvious that this is a questionable practice that will undoubtedly result in sparking and burning of the commutator.

Another source of poor commutation not commonly recognized is inadequate soldering of leads to the commutator bars. This increases the resistance thereby changing the flow of current between the coils and the bars. Thus, the bar with the poor joint does not carry its full share of current. If the joint is poor bits of melted solder will be found around these joints.

Another cause of poor commutation is a short in the main field winding. This upsets the equality of the flux around the armature thereby resulting in poor commutation. It is frequently found in motors around the 5 hp. size. Good commutation insures continuity of service and only results when a planned maintenance program is followed assiduously.

Caterpillar Changes Sales Personnel

SEVERAL changes in the General Sales department of Caterpillar Tractor Co. have been announced by H. H. Howard, General Sales Manager of the company. F. D. Haberkorn has been appointed Assistant Sales Manager of the Central Sales division; C. A. Barabe, Jr.

. . . . *And now please turn to page 100* . . . .

Neither Mud nor Japs Could Stop These Tractors on Okinawa

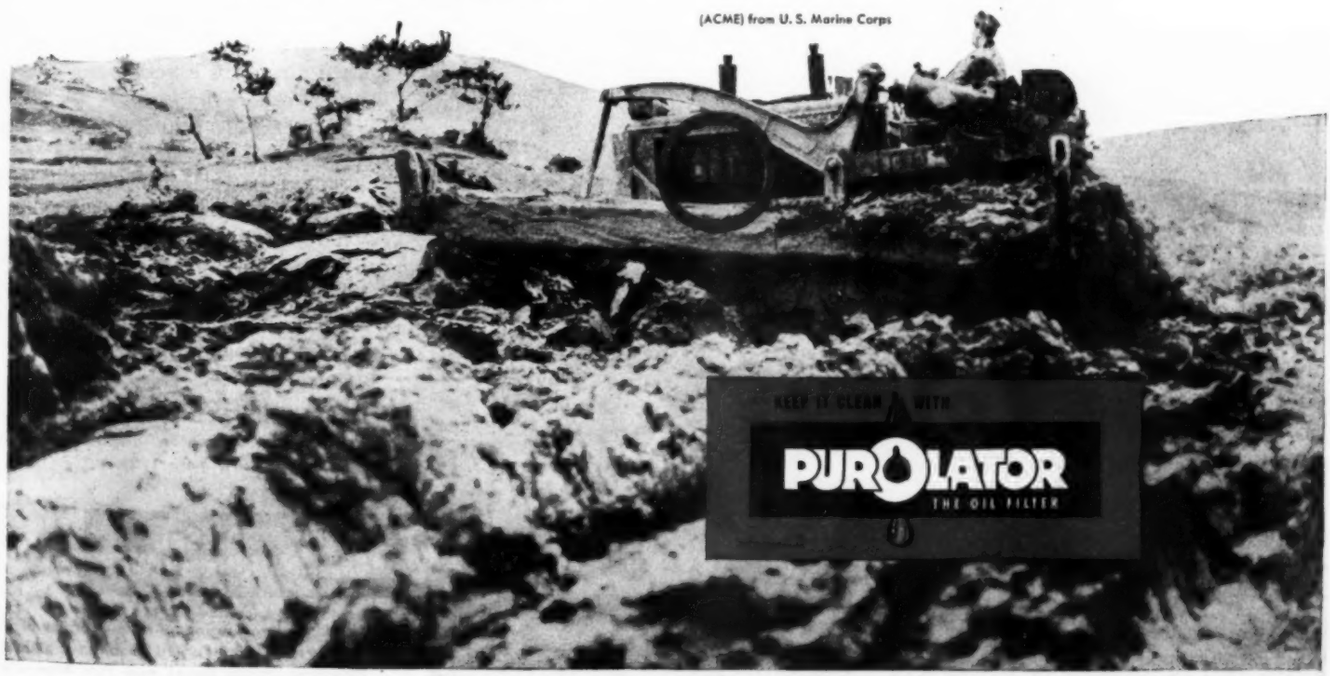
(ACME) from U. S. Marine Corps

THE MUD OF OKINAWA proved almost as tough to overcome as the Japs. These photos of International Diesel TracTracTors in action on Okinawa show the mud and grime through which these tractors had to plow their way. But the motors were kept free from grimy abrasives because Purolator Diesel filters trapped the motor-damaging grime as the lubricating oil passed through the filter. Grimy abrasives could also have clogged the fuel oil apertures but here again the Purolator Filter kept power on the move.

Purolator Oil Filters are protecting Diesel engines on tractors, trucks, ships and stationary engines the world over. In fact, there are more Diesel Purolators in use today than all other types of Diesel oil filters combined. Purolator Products, Inc., founder and leader of the oil filter industry, Newark 2, New Jersey. In Canada: Purolator Products (Canada) Ltd., Windsor, Ont.

Purolator offers a complete line of filters for both lubricating and fuel oils. Constant development work assures the adaptability of the Purolator line to both old and new engine designs, on both land and sea.

(ACME) from U. S. Marine Corps



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has been named Assistant Sales Manager of the Eastern Sales division; and F. E. Rusher, Assistant Sales Manager of Central Sales since 1937 has resigned to become General Sales Manager and a director of Peoria Tractor & Equipment Co., "Caterpillar" distributor in the Peoria area.

F. D. Haberkorn

Mr. Haberkorn joined "Caterpillar" ten years ago as a member of the Sales Training division and has had eight years of field experience in several territories, both as agricultural representative and district representative. Since September, 1944, he has been Assistant Sales Manager of Eastern Sales.

C. A. Barabe

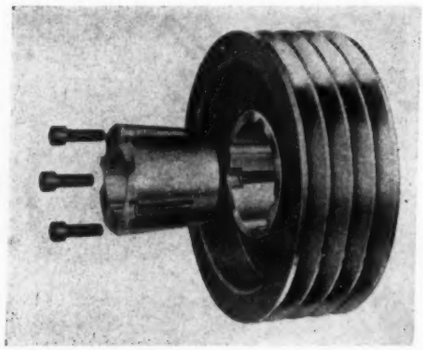
Mr. Barabe joined the company in 1937 and traveled extensively as a special representative and earthmoving authority. Early in the war he entered the U. S. Army, serving in the North African, Sicilian and Italian campaigns. Returning to Peoria in 1944 as lieutenant colonel, retired, he resumed his work as consultant on earthmoving.

F. E. Rusher

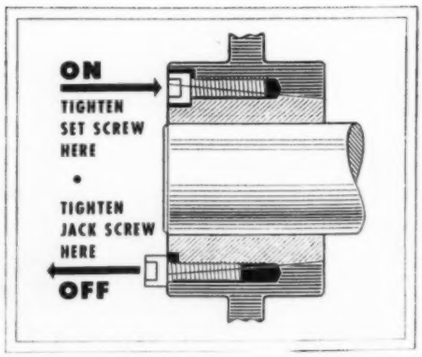
Mr. Rusher has been a member of the "Caterpillar" organization since 1931. He served first as a district representative, then as agricultural sales supervisor, from 1935 to 1937 when he was promoted to Assistant Manager of Central Sales.

New Taperlock V-Belt Sheave

THE Taperlock V-belt Sheave just released by the Dodge Manufacturing Corporation, represents a new and effective means of quickly mounting and demounting V-belt sheaves.



To install the Taperlock Sheave, it is only necessary to slip the sheave and bushing assembly onto the shaft and tighten two or three locking screws depending upon the size of the sheave. The screws are in threaded engagement with the sheave hub and free in the bushing groove. As the screws are tightened, they push against the tapered bushing forcing it into the tapered bored hub. This causes the bushing to contract and wedge between the hub and shaft on which it is installed.



To remove the sheave from the shaft, the locking screws are removed and one or two of them are inserted in jack screw holes, which are partially in the bushing and partially in the hub. The portion of the jack screw hole in the bushing is threaded and that in the hub portion is unthreaded. As the screws are tightened, the bushing is dewedged and the sheave is free for removal from the shaft.

This construction provides a mounting of minimum dimensions for accommodation of the screws and their connection with hub and bushing. It permits the use of a flangeless bushing and eliminates any extension of either hub or bushing or any collars or protruding parts. This reduces weight and facilitates mounting and demounting.

The wedging action provided gives the equivalent of a shrunk-on fit on the shaft whether it is standard or normally undersize. The bushing extends the entire length of the hub providing a full bearing surface. Close mountings are made possible because of elimination of flanges and collars. For full particulars write Dodge Manufacturing Corporation, Mishawaka, Indiana.

New General Motors Technical Center Announced

CITING modern science as the real source of economic progress and the creator of a higher standard of living with more and better job opportunities, Alfred P. Sloan, Jr., chairman of General Motors, recently announced what is believed to be an entirely new concept of industrial research through corporation plans for what will be known as the General Motors Technical Center. This will consist of a group of buildings which will provide facilities to meet tomorrow's needs for the corporation's research, advanced engineering, styling and process development sections of its general staff activities.

. . . . *And now please turn to page 104* . . . .

. . . . *Continued from page 102* . . . .

The various buildings comprising the General Motors Technical Center will be grouped around a central esplanade within which will be a seven-acre lake which in itself fills a useful purpose in the operations of the Center. The buildings will be of contemporary functional architecture. The Center will be erected on property one and one-half miles long and about half a mile wide covering approximately 350 acres, just outside of Detroit, Mich. Construction will start as soon as complete clearance on materials and labor can be obtained from proper Government agencies.

"Naturally, the cost of such a project will be substantial. It should be looked upon as an investment in industrial progress," Mr. Sloan stated.

In making this announcement at a "More Jobs Through Research" luncheon in the Waldorf-Astoria before a representative group of scientists, educators, editors, engineers and industrialists, Mr. Sloan further declared:

"This new Technical Center represents long-considered plans of General Motors to expand, at the right time and on a broad scale, its peacetime research, engineering and development activities. And even more progressively pursue its prewar policy of continual product improvement. Thus, to accelerate not only the development of new products through the utilization of new inventions as well as the application to the art of metal fabrication of scientific knowledge through the use of materials and advanced technological processes discovered and developed over the years. The end objective is more and better things at lower prices, thus expanding job opportunities and contributing to an advancing standard of living. . . ."

The Surplus Engine Picture

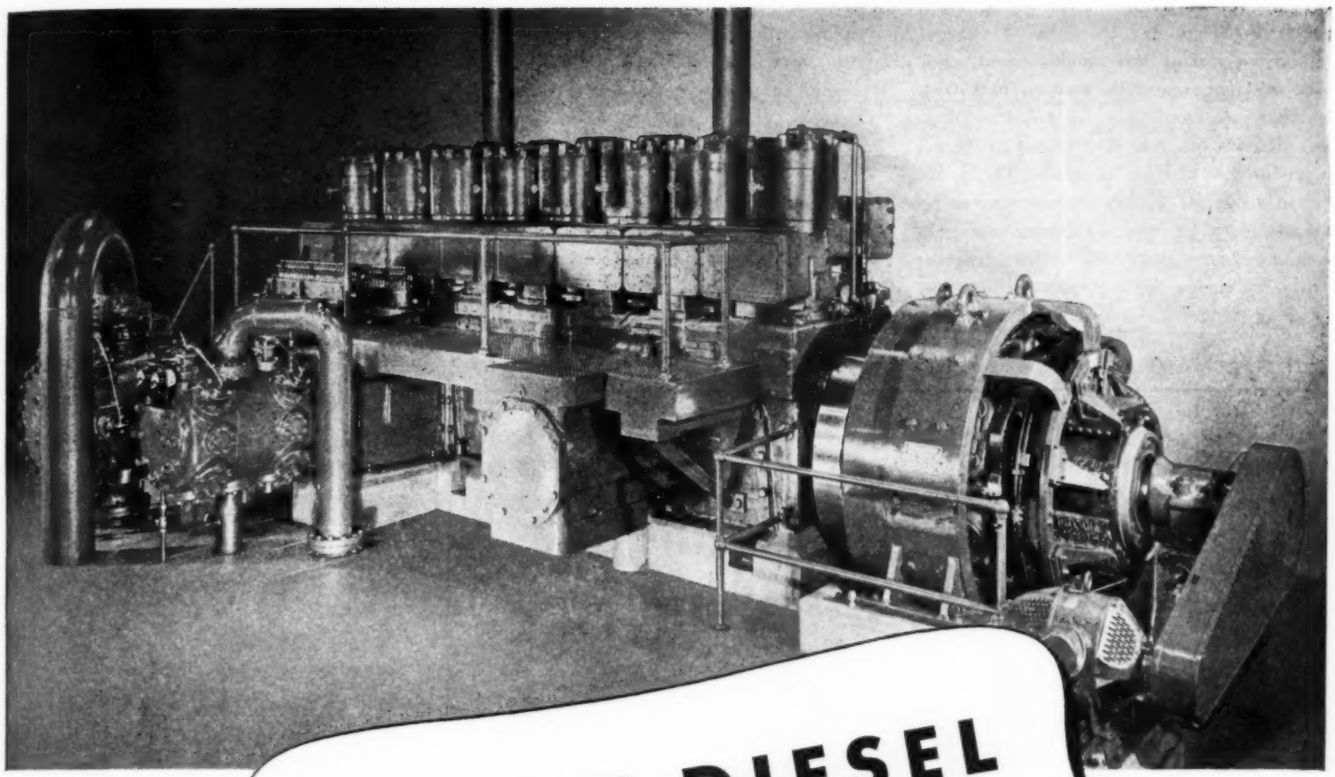
AS recently reported on good authority the surplus engine situation appears unalarming. The Maritime Commission has less surplus engines today than it has ever had since it took over the disposal of all surplus and the Commission does not see where any considerable number of surplus engines are going to be found—at least until the end of the war in the Pacific.

In July there were available as surplus about 40 heavy duty type Diesels of various makes ranging from 240 to 1400 hp. and 20 high-speed type of 150 hp. Twenty-seven R.F.C. offices throughout the country reported in July that they had no Diesel-generating sets for sale but there were a few second-hand Diesels at various points, also two 60 hp. engines at Lexington, Kentucky and some 450 high-speed type engines in Chicago. The conclusion of our informant is that there will be no serious surplus engine problem until the Pacific war is over and as that time approaches the situation will probably be kept well in hand.

Knudsen Reelected To General Motors Board

THE Board of Directors of General Motors Corporation, at a recent meeting, elected Lieut. Gen. William S. Knudsen a member of the Board, from which he had resigned Sept. 3, 1940, after having entered the service of the Government in the national defense program. At that time Lieut. Gen. Knudsen severed all his official relations with General Motors, including the presidency and membership on the Corporation's Policy and Administration Committees.

. . . . *And now please turn to page 106* . . . .



CLARK DIESEL
DOES DOUBLE DUTY

As the power unit in an industrial power plant, this 1000 BHP Clark 8-cylinder Diesel engine serves in a dual capacity.

The compressor end of the Diesel compresses 2000 cubic feet of air per minute, from 0 to 100 lbs. pressure in two compression stages.

A 700 Kw. generator is hooked up on the generator end to furnish power for the plant.

The compressors are so arranged that they can be "unloaded" and the horsepower normally used for air compression can be shifted to handle an additional generator load.

Clark Model RAD Diesels are made in the following sizes: 200, 300, 400, 500, 600, 800 and 1000 BHP. All Clark Diesels, whether for industrial or marine use, are noted for extraordinary simplicity of design and accessibility of parts. They have an outstanding performance record.

Wire or write for complete information.

CLARK BROS. CO., INC., OLEAN, N. Y.

New York, N. Y. • Chicago, Ill. • Boston, Mass. • Tulsa, Okla.
Houston, Tex. • Los Angeles, Cal. • Washington, D. C.

CLARK

ONE OF THE DRESSER INDUSTRIES

HEAVY-DUTY, 2-CYCLE DIESEL

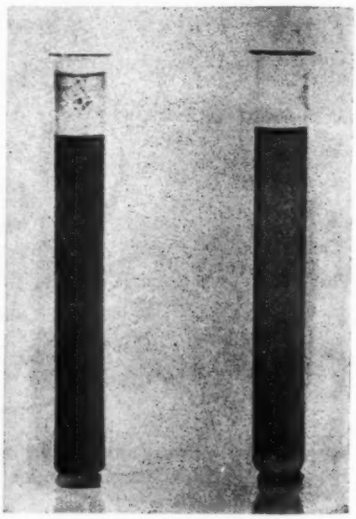
. . . . *Continued from page 104* . . . .

Alfred P. Sloan, Jr., chairman of General Motors, in making this announcement, said: "We most enthusiastically welcome back Gen. Knudsen as a member of our Board of Directors after his splendid contribution to the national defense and war programs. He cannot be too highly praised for the unstinting use of his talents and energies in the national emergency, as a member of the National Defense Advisory Commission, Director General of the Office of Production Management, and as a lieutenant general of the United States Army serving both as Director of Production for the War Department and as Director of the Air Technical Service Command."

The Board of Directors also elected Col. Graeme K. Howard a vice president of the corporation. Mr. Howard resigned as vice president in charge of Overseas Operations on March 2, 1942, to become deputy chief, Motor Transport Division, Quartermaster Corps, United States Army. He subsequently served as deputy chief of the Tank Automotive Center in Detroit, Mich. In February, 1944, he was ordered to England for service with Supreme Headquarters Allied Expeditionary Forces. Col. Howard, after three and one-half years' service with the Army, has been placed on inactive duty and returned to General Motors Overseas Operations on Aug. 1 as European regional manager.

"Induco Fluid" Cleans Diesel Fuel Oil

WHEN added to Diesel fuel oil, "Induco Fluid" chemically converts sludge, gums and resins into usable Hydro-Carbon elements. The undesirable materials are placed in suspension in the fuel oil and consumed in combustion as usable Btu's, increasing combustion efficiency and raising the power output of the engine. By the removal of sludge and lamp black from the fuel oil, smoking and the formation of hard carbon is eliminated, according to the manufacturer.



"Induco Fluid" is the development of W. W. Weel, Combustion Engineer of the Industrial Chemical Company, and represents seven years research on the problem in laboratory and refinery. The result of "Induco Fluid" added to a standard brand of Diesel fuel oil is shown in the unretouched photo. In the test tube on the left a sediment of sludge is clearly visible. In the second test tube this sludge is eliminated, and a clear uniform oil has resulted after the addition of "Induco Fluid."

Additional information concerning the use of "Induco Fluid" for Diesel trucks, Diesel Marine engines, Diesel tractors and Diesel Stationary engines, or concerning distributor territories available, may be obtained by writing to: Industrial Chemical Company, 628-630 West 9th Street, Los Angeles 15, Calif.

Charlie Foell Resigns Diesel Power

CHARLES F. FOELL, for the past three years editor of DIESEL POWER & DIESEL TRANSPORTATION, recently resigned and has joined Socony-Vacuum Oil Company as a technical writer in the Lubricants Division effective August 1st. As editor of DIESEL POWER, Charlie Foell became very well known throughout the Diesel industry. His many friends will wish him well in his new connection.

How to Usefully Harness Atomic Energy?

THE answer to the question, "How to usefully harness atomic energy" is not yet clear. The ultimate solution may be quickly reached or let us say, may be within reach somewhat coincident with achievement of a means of controlling the rate at which atomic energy is released once the "trigger" is pulled. That we have a machine (the gas turbine) which, in its basic form, appears to be capable of absorbing atomic energy (properly controlled), and of delivering such energy in the form of useful work is one long step toward the goal.

Immediately following the first Atomic blast on Japan, in fact on August 7, last, R. Tom Sawyer, chairman of the Gas Turbine Coordinating Committee of the Oil and Gas Power Division of A.S.M.E., called his committee to active consideration of the above problem. In his letter to the committee, Mr. Sawyer said in part:

"My thought on this question is that atomic power may not be properly controlled for many years. However this committee should start now to consider how it can assist in utilizing atomic power to drive the gas turbine as the gas turbine should be the ideal means of obtaining mechanical energy from atomic power.

"If we could take a small bomb and release its power bit by bit into a jet propulsion unit, we would, no doubt, have a plane which would fly from here to China without refueling. The objection would be the high price of the 'fuel.' The advantage would be a light fuel load with extra pay load. It would then no doubt require many more years of experimentation before this fuel became cheap enough to use competitively in ships or locomotives. The last place would be in stationary service where weight is a minor item.

"Incidentally, it should be mentioned that any one who questions the desirability of putting money into the development of the gas turbine today, will now realize that the success of the gas turbine is now already here, as compared to the controlling of atomic power."

A New Era in Flow Rate Measurement

FISCHER & Porter Company offers the third, revised edition of "A New Era in Flow Rate Measurement," which discusses and illustrates the advantages of the rotameter for flow rate measurement. You will find these 32 pages interesting reading and yet the most informative material you have yet encountered on rotameters and their applications. Each basic advantage of the rotameter—its extremely high accuracy—its linear flow curve—its wide flow range—the ready visibility of the metering elements and fluid—the immunity of the Fischer & Porter Ultra-Stablvis rotameter to variations in viscosity and specific gravity—and other advantages are clearly discussed and extremely well illustrated.

The busy executive or engineer can read this absorbing catalog in about 15 minutes time. For a free copy of Catalog 10-C write Fischer & Porter Company, 94107-C County Line Road, Hatboro, Pa.

"Enginairing"

permits greater tonnage trains . . .
permits work boats to handle more cargo

The whole history of industrial progress in America can be summed up in one phrase: the continuous development of machines and equipment that do bigger and bigger jobs better and better!

This development brought a number of problems that Enginairing has helped, and is helping, to solve. As railroad trains got longer, for instance, greater flexibility in applying and releasing the brakes throughout the length of the train was essential. How well Enginairing did the job is shown by the mile-long trains that are handling the greatest freight traffic in the history of transportation.

Enginairing is making a big contribution in another field too—work boats . . . floating derricks. Instead of muscling a long row of heavy levers, the operator governs all functions by the movement of a few small handles. The magic of air multiplies a finger touch on the controls to any operating pressure needed, and simple interlocks prevent accidental damage to the equipment.

In post-war days, pneumatic controls may help you in modernizing your products, and streamlining your production. When that time comes, remember that Enginairing will be ready to serve you.

WESTINGHOUSE AIR BRAKE COMPANY

INDUSTRIAL DIVISION

General Offices:
WILMERDING, PA.

WABCO PACKING **COMPRESSORS** **REMOTE CONTROLS**

DoALL Appoints E. R. Haan

APPOINTMENT of E. R. Haan as Director of Advertising of the DoALL Company, distributors of contour saws, other advanced industrial tools, and ultra-precision measuring instruments, is announced by Leighton A. Wilkie, General Manager. Technical Editor of Popular Mechanics Magazine for many years, Mr. Haan's work at popularizing machine-shop and craft work for nearly a quarter of a century with that magazine, has been credited with much of the widespread public acceptance of the mechanized workshop movement, and its rapid growth. With the DoALL Company, Mr. Haan will continue his promotional activities in the machine-tool field. He plans a vigorous extension of DoALL's aggressive policy, which he describes as, "Foremost in the field with progressive shop and new-idea information for users and buyers of machine tools."

New Vibration Control Bulletin

VIBRATION control is now being applied to many kinds of machines and equipment in varied industries. The effects of vibration on plants, equipment and personnel and methods of controlling vibration are explained in a new 12-page bulletin "Vibration in Industry," published by The Korfund Company, Inc., 48-15 Thirty-second Place, Long Island City 1, New York.

Hobart C. Ramsey Named President of Ransome

HOBART C. RAMSEY, Executive Vice President of Worthington Pump and Machinery Corporation has in addition, been named President of the Ransome Machinery Company, subsidiary of Worthington in Dunellen, N. J., where concrete mixers and road pavers are made. The appointment is effective August 1st.

H. C. Ramsey

Also named Vice President and General Manager of the Dunellen plant is J. G. Ten Eyck, who has just completed five years active service with the U. S. Navy and who was formerly President of the industrial engineering firm of Ten Eyck, Inc. Kenneth W. Horsman, formerly Superintendent of Welding and Steel Fabrication at the Worthington Harrison Works has been transferred to Ransome as Works Manager.

Newly elected directors of the Ransome Company are Mr. Ten Eyck and Carl F. Oechsle, Vice President in charge of sales.

Vincent Brass Appoints Control Manager

ANTICIPATING increased activity, in the postwar market for automatic controls, Vincent Brass & Copper Co., Inc. of Minneapolis, Minn. has recently named Edmund T. Dowd as manager of their control division. A graduate of the University of Minnesota, Mr. Dowd is an

. . . . *And now please turn to page 116* . . . .

. . . . *Continued from page 114* . . . .
experienced engineer well-versed in the application of automatic controls. Before joining Vincent Brass, Mr. Dowd was sales engineer with Minneapolis Honeywell for approximately nine years.

Vincent Brass are sole distributors in the Minnesota, No. Dakota, So. Dakota and parts of northern Wisconsin territory for automatic controls built by Penn Electric Switch Co. of Goshen, Indiana.

Liquidometer Hydraulic Position Transmitter

A NEW means of transmitting signals from bridge to engine room of a vessel through use of a hydraulic transmission system has grown out of the combat experience of U. S. Navy PT boats, according to John J. Cosgrove, Manager, Marine Division, The Liquidometer Corporation.

Use of the Liquidometer hydraulic position transmitter as an engine room telegraph and warning signal system was developed by The Liquidometer Corp. in conjunction with the Elco Naval Division of the Electric Boat Company, Bayonne, N. J., to provide motor torpedo boats with a reliable signal system for wartime conditions.

The tremendous power and speed of the PT boats and the necessity for maneuvering in close quarters require instantaneous transmission of signals from pilot to engineer. The transmitter must also continue to function even if the boat's electrical system should fail temporarily.

View showing installation of Liquidometer hydraulic transmission system on a Navy PT boat.

With the Liquidometer hydraulic transmitter, signals go to the engineer whenever the pilot moves the engine throttle control handle to "Ahead," "Neutral" or "Back." This motion is instantly transmitted to an indicator dial marked "A," "N" and "B" in the engine room. Utilizing a dual hydraulic transmission system which automatically compensates for expansion or contraction due to temperature changes, the Liquidometer transmitter does not depend on electricity or any other outside source of power. The large letters on the engine room dial are finished in fluorescent paint so that even in the dark the operator can see them from any place in the engine room, and instantly respond to signals from the bridge.

Further information on Liquidometer position transmitters can be obtained by writing The Liquidometer Corp., Marine Division, 41-38 37th Street, Long Island City 1, New York.

Joe Elliott Joins Petroleum Solvents

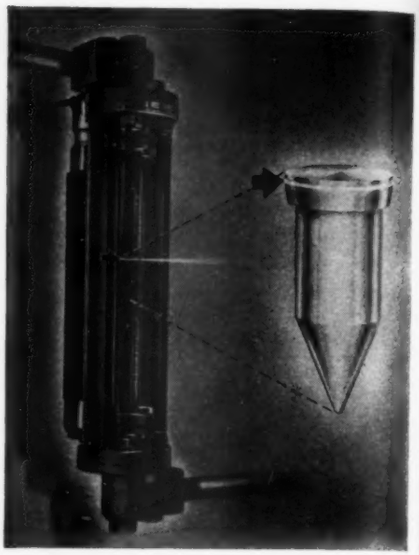
JOSEPH ELLIOTT of Minneapolis, has been added to the sales staff of the Petroleum Solvents Corporation. He will operate in the Northwest territory under Harry French, District Manager. Mr. Elliott served overseas in both World Wars I and II. Mrs. Elliott is also in the service as 1st Lieutenant in the WAC.

Briggs Clarifier Appoints W. J. Sommers

THE Briggs Clarifier Company has announced the appointment of W. J. Sommers, 505 Delaware Avenue, Buffalo, New York, as Distributor covering Western New York State and Northwestern Pennsylvania. Widely experienced in the distribution of industrial products, Mr. Sommers has a thorough knowledge of the territory. His firm is organized to give prompt and efficient service to all Briggs present and prospective customers.

New Line-O-Light Rotor For Any Rotameter

FOR sharp, clear Rotameter readings of opaque liquids, the new patented Schutte & Koerting Line-O-Light rotor is especially well suited. This rotor, having the same basic design as a standard SK rotor, has a disc of light-transmitting material sandwiched in the rotor head which substantially reduces the distance that the light must travel through the opaque liquid from its source behind the tube. Rate-of-flow is thus delineated sharply in the resultant band of light on the tube reference scale and operators can make easy, accurate readings.

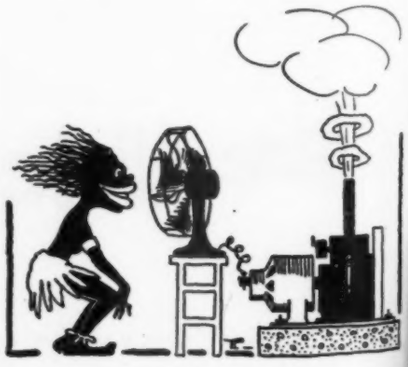


Line-O-Light Rotor Applied to Rotameter.

This Line-O-Light rotor can be used for practically any application and in any type tapered glass tube rotameter. Two types of discs can be furnished: Lucite for general applications and Pyrex glass for extremely hot or highly corrosive fluids. For full particulars write Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia 22, Pa.

Detroit Diesel Appoints New Orleans Distributor

GEORGE Engine Company of New Orleans has been appointed industrial and marine distributor in the State of Louisiana for the Detroit Diesel Engine Division of General Motors Corporation. The company has a full stock of parts and service facilities for GM-Detroit Diesel engines and Gray marine Diesel engines and immediate shipment can be made from factory of new engines subject to priority restrictions.



New Hydraulic Pump For Tractor Use

A NEW aircraft type pump supplying hydraulic power for the control of tractor-mounted implements is expected to lighten farm work and increase labor productivity, according to an announcement by R. J. Minshall, president of Borg-Warner's Pesco Products Company division at Cleveland. No larger than a man's two fists, the new pump runs off the tractor engine. The hydraulic pressure it provides will raise or lower, at the flip of a handle, plows, harrows, cultivators and other implements mounted directly on the tractor.

Developed by Pesco, the tractor pump is an adaptation of the Cleveland company's gear type, pressure loaded pump for aircraft use. Similar hydraulic systems are used in military planes to operate bomb bay doors, landing gear, wing flaps, turrets and other moving parts.

Advantages claimed for the new tractor pump are unusually high overall efficiencies through the full range of operating temperatures that might be encountered; and exceptionally long service life of the pump itself accomplished by automatic adjustment of end clearances which compensates for wear.

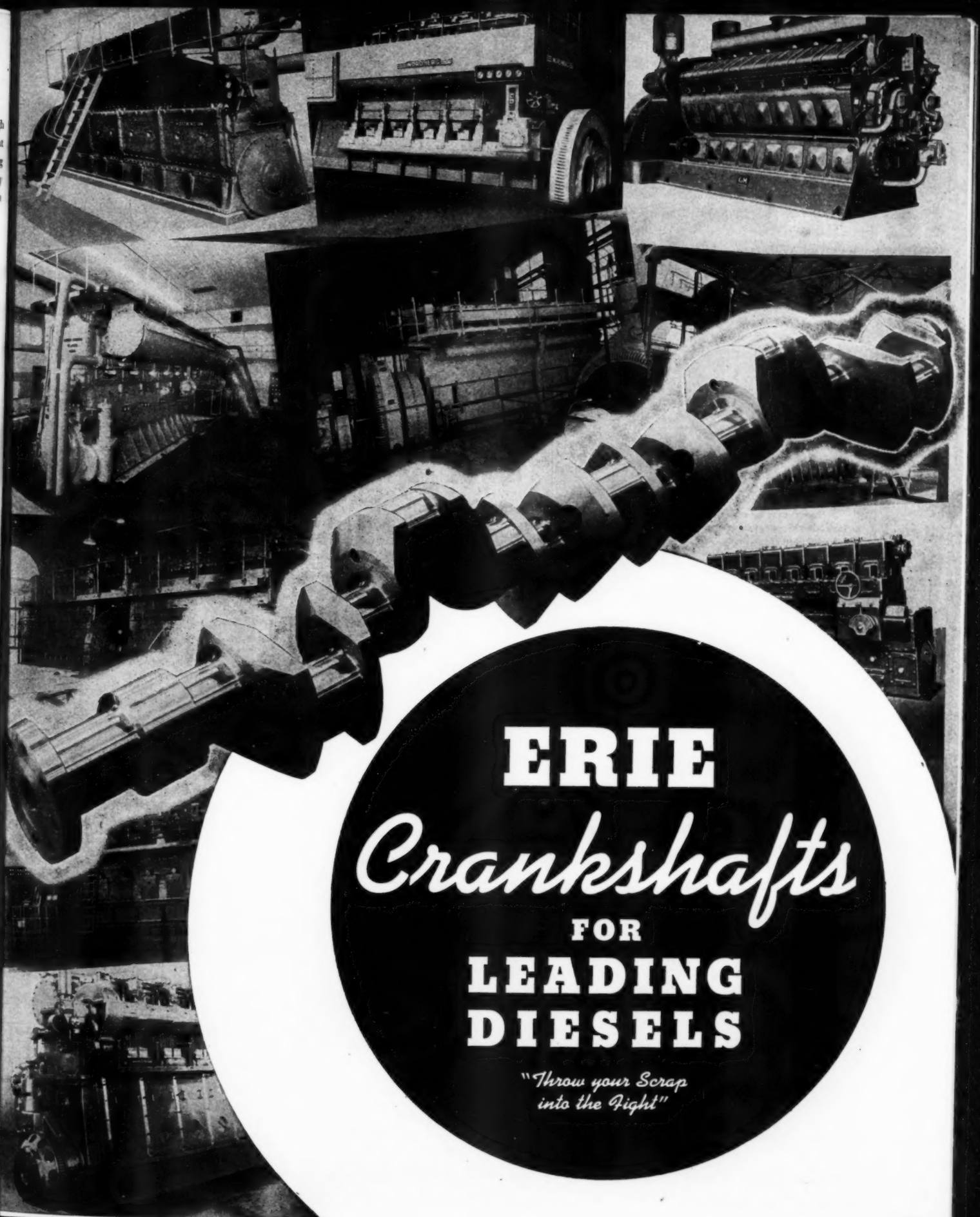
H. A. Feldbush Named Engineering Vice President

Harry A. Feldbush

HARRY A. FELDBUSH, formerly Works Manager of the Holyoke, Mass. plant of Worthington Pump and Machinery Corporation has been named Vice President in charge of Engineering for the entire corporation. His duties cover engineering activities of all works and domestic subsidiary companies. His headquarters will be at the general offices in Harrison, N. J. Ralph M. Watson, formerly chief engineer of the Centrifugal Engineering Division has been appointed Assistant to Mr. Feldbush.

Dry Land-built Diesel Tug Trucked To Waterside

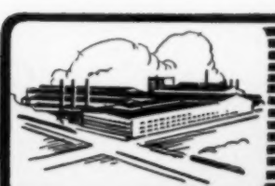
Floating the Diesel tugboat "Janet Fulton" to water may be awkward, but its not an especially hard job for this Mack Diesel truck, owned and operated by M.C.M. Truck Line of Houston, Texas. The tug, without engine or deck, weighed almost 22 tons and was 42 feet long and 12 feet wide. Built by the Fulton Construction Company, it will be used by the firm in its construction work in the oilfields off the Gulf Coast.



ERIE
Crankshafts
FOR LEADING DIESELS

"Throw your Scrap into the Fight"

ERIE FORGE COMPANY, ERIE, PA.



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Hyland, Mechesney, Appointed to Westinghouse Posts

APPOINTMENT of G. A. Hyland as sales manager of the new Westinghouse Aviation Gas Turbine Division was recently announced by George H. Woodard, Division manager. Mr. Hyland succeeds W. F. Boyle, who has resigned. Mr. Woodard also announced the appointment of William A. Mechesney as manager of the Contract Negotiation Department for the Division.

Mr. Hyland was reared at Phoenixville, Pa., and received his Bachelor of Science degree in mechanical engineering at Pennsylvania State College in 1925. He joined the Westinghouse Electric Corporation the same year and since has served in the Sales Department, leaving a position as manager of Ordnance and Emergency Products in the Washington, D. C., office to accept his new position.

A native Pennsylvanian, Mr. Mechesney was born at Wilkinsburg, and was graduated from Penn State College in 1934, with a Bachelor of Science degree in industrial engineering. He came to Westinghouse in 1937, and after sales training, was employed at the company's Pittsburgh district sales office and the Wheeling, W. Va. Branch.

Seanor Named Manager of Mack Export Sales

APPOINTMENT of H. E. Seanor as vice president in charge of export sales for Mack was recently announced by A. C. Fetzer, vice president of Mack-International Motor Truck Corp. Mr. Seanor joined the Mack organization in 1939 as a special sales representative in the firm's Chicago office. Mr. Seanor started his automotive career in 1908 in Waterloo, Iowa, where he was associated with Fred Dusenberg. His truck association began in 1915 when he joined the White Motor Company, with whom he remained until he joined Mack in 1939.

H. E. Seanor

As advisor on off-highway trucks to the Office of Production Management and its successor, the War Production Board, Mr. Seanor was largely responsible for the great expansion in the use of giant trucks up to 50-ton capacity in mines to accelerate the production of raw materials for the war effort. He also introduced the use of giant Diesel trucks in the building of the Third Locks of the Panama Canal. When war halted work on the locks, the trucks were shipped to the Aleutians, Hawaii, Australia, and some wound up on Guam.

In assuming his new position, Mr. Seanor declared, "Mack intends to take a much more active part in the export market. With that in mind, a good percentage of future production will be earmarked for export sale." Since 1941, Mr. Seanor has been vice president in charge of the Mack Public Works and Mines Division. In his new post, he will continue management of the division. He will make his headquarters in Mack's home office in New York's Empire State Building.

AMERICAN MERCHANT MARINE
CONFERENCE COMMITTEE

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Bath Iron Works Corp.
C. J. PANNILL
Radiomarine Corp. of America
L. D. PARMELEE
AGWI Steamship Lines, Inc.
HARRY W. PARSONS
Parsons Engineering Co.
JOHN G. PEW
Sun Shipbuilding & Dry Dock Company
HENRY H. REED
Insurance Co. of North America
JOHN D. REILLY
Todd Shipyards Corporation
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Combustion Engineering Co.
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O. B. WHITAKER
Sperry Gyroscope Co.
A. T. WOOD
Lake Carriers Association

Post War Aspects of the American Marine Industry

will be discussed at the

AMERICAN MERCHANT MARINE CONFERENCE

THE WALDORF-ASTORIA — New York City

October 17, 18 and 19th, 1945

THE Propeller Club of the United States and the American Merchant Marine Conference, under the auspices of the Propeller Club, Port of New York, will hold their Nineteenth Annual Regional Meeting.

Problems of vital importance to the future of the American Marine Industry growing out of the inevitable period of transition from an economy of war to one of peace will be explored and discussed by recognized authorities. The Conference will concentrate the experience and wisdom of its outstanding leadership upon subjects of transcending importance affecting the post-war ascendancy of the Merchant Marine.

Numerous Panel Discussion Meetings will again assure valuable plans for the future of the industry. The American Merchant Marine Conference dinner will be held on the evening of October 19th.

The need for coordinated and constructive effort was never so necessary as at the present time . . . Your help and participation are needed in this program to foster the best interests of the American Merchant Marine for our military and economic defense . . . Arrange now (if you live in the metropolitan New York area) to attend the Merchant Marine Conference, and to take part in this most important annual gathering of the American Marine Industry.

ARTHUR M. TODE, Hon. President
The Propeller Club of the United States

J. LEWIS LUCKENBACH, Chairman
American Merchant Marine Conference Committee

JOHN F. GEHAN, President
Propeller Club of the United States

L. D. PARMELEE, President
Propeller Club, Port of New York

For Complete Details and Advance Program, address

National Headquarters

17 Battery Place **New York 4, N. Y.**

Everyone should carefully heed the expressed policy of the Office of Defense Transportation against all unnecessary travel unless specifically in the interests of the war effort.

Two Cooper-Bessemer Officials Elected to Board of Directors

STANLEY E. JOHNSON, general sales m ager of The Cooper-Bessemer Corporation elected a vice president and member of board of directors and Charles G. Cooper, m ager of the company's Washington office also elected to membership on the board was announced recently.

Stanley E. Johnson, left; Charles G. Coop right.

Mr. Johnson, who has been connected with company since his graduation from Michig State University in 1918, has been in charge sales for one year. He began his Coop Bessemer career as a member of the sales partment. Prior to attending Michigan St Mr. Johnson was a student at Ohio Wesley University. He served in World War I a Marine.

Mr. Cooper is the son of the late C. G. Coop former company President and a grandson the Elias Cooper, one of the company's fou ders. He graduated from the Sheffield Scienti School of Yale University in 1926. He serv as a field and service engineer and subsequent sales engineer with the Chapman Stein Co pany, a former Cooper-Bessemer subsidiary u til 1931. Mr. Cooper joined the New Yo office of The Cooper-Bessemer Corporation a sales engineer in 1931 and in July, 1933, estab lished the Washington office which he has ma aged since that date.

Sperry Advances R. E. Erbentraut

R. E. ERBENTRAUT has been made A sistant Marine Sales Manager of the Sperr Gyroscope Company. A native of Wellington Kansas, Erbentraut studied electrical enginee ing at Kansas State College and Manhattan and in 1935 obtained an appointment to th U. S. Naval Academy at Annapolis. Joining the Field Service department of the Sperr Gyroscope Company shortly after his gradua tion from the Naval Academy with a Bachelo of Science degree in engineering, he served a marine service engineer on a wide variety o assignments before being placed in charge o the marine service office at Boston in 1942

Later that same year, Erbentraut was recalled to Brooklyn to a position in the Marine Sales Department.

R. E. Erbentraut

In his new position, Erbentraut will assist Marine Sales Manager O. B. Whitaker in directing Sperry's marine activities. Professional memberships include Society of Naval Architects and Engineers; the American Society of Naval Engineers; and the Propeller Club, Port of New York.

New Hardness Tester For Large Parts

CLARK Instrument, Inc., manufacturers of the Clark Hardness Tester for "Rockwell" testing, announce the production of a new model to handle large or cumbersome parts. This new Clark Hardness Tester also gives a true "Rockwell" reading, using either a diamond or steel ball penetrator, both furnished as standard equipment with the machine. The outstanding feature of the new model is its capacity. It can handle parts ranging from ½ in. to 26 in.

Provision is made for raising or lowering the table by means of a hand crank. Position of the capstan, mounted on the side of the machine, may be correspondingly adjusted in relation to the table height. Heavy parts are loaded onto a roller bearing carriage on the table, providing an easy method of positioning. Readings are taken exactly as with the ordinary "Rockwell" tester. By means of the capstan the indicator is set at zero on the minor loads. The major load weight is released and a direct hardness reading is taken from the indicator. Further information may be secured from Clark Instrument, Inc., 10200 Ford Road, Dearborn, Michigan.

Cooper-Bessemer Appoints Canadian Representative

APPOINTMENT of the Northern Marine and Engine Company of Toronto, Canada as its representative in the territory embracing the Provinces of Ontario and Quebec in Canada; New Brunswick, Labrador and Prince Edward Island, Canada, is announced by The Cooper-Bessemer Corporation. The new representative

will distribute Cooper-Bessemer's full line of stationary and marine Diesels and air-starting compressor units for any application approved by the manufacturer, according to Stanley E. Johnson, Vice President and Director of sales. The appointment is in line with the company's policy of expanding its sales and distribution facilities for engine and compressor products in postwar markets, Mr. Johnson said.

General Motors Trains Diesel Coach Operators

A SPECIAL cooperative program between Detroit Diesel Engine Division and G M Truck & Coach Division for the training of superintendents, foremen and mechanics operating coaches powered by the GM Series 71 Diesel engine was announced recently by V. C. Genn, General Sales Manager for Detroit Diesel.

This course is conducted at the General Motors Institute in Flint, Mich., covering the complete disassembly, assembly of the engine and its subassemblies.

Group of recent trainees at the General Motors Detroit Diesel Engine Division plant.

On the second Monday of the course the trainees visit the Detroit Diesel plant where they are taken on a conducted tour providing them with the opportunity of seeing the engines built on a production basis. The trainees then proceed to the GMC Truck & Coach plant at Pontiac, Mich. At this plant they see the engines installed in the coaches and witness the complete assembly of the coach itself.

National Supply Promotes Tiemann

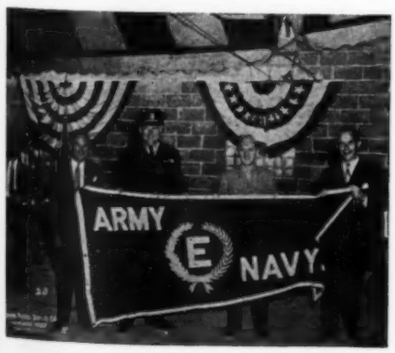
WILLIS F. TIEMANN has been appointed works manager of the Superior Engine Division of The National Supply Company at Springfield, Ohio. He has been with Superior since 1933, holding various positions as foreman, superintendent of assembly, plant superintendent, general plant superintendent, and assistant works manager prior to his recent promotion.

Willis F. Tiemann

Tiemann replaces John D. Spalding who resumes his former duties as works manager of National's Torrance, California plant. ,

Price Battery Receives Army-Navy "E"

ON July 13th, the Price Battery Corporation of Hamburg, Pennsylvania was presented with the coveted Army-Navy Production Award for excellence in production of storage batteries for the Armed Forces. Fourteen months before Pearl Harbor, this company began to build batteries for the Navy and Army. Since that time it has produced many thousands of special batteries for use on ships of all types and in jeeps, tanks, trucks and bulldozers. They are used, not only for engine starting, but also as auxiliary power for gun-firing, radio, communications system, alarms, searchlights, rangefinders, fire-fighting and auxiliary lighting.



Holding the "E" Award pennant in the photograph above are, left to right: William F. Price, President of the company; Captain John E. Wood, U.S.N., who made the award presentation; Major J. I. Wexlin, who presented the "E" pins to employees; and S. Dershwin, Vice-President and Treasurer of the company.

Penn Names New Branch Managers

R. H. LUSCOMBE, sales manager of Penn Electric Switch Co., has announced the appointment of three new branch managers and the opening of a new branch office in Milwaukee, Wisconsin.

E. M. Smith

E. M. Smith, formerly manager of the company's Detroit office, has been transferred to the home office and effective July 1, will be manager of the Goshen factory sales branch covering northern Indiana, part of western Ohio and southwestern Michigan.

G. Orr Sanders

G. Orr Sanders was employed recently to succeed Mr. Smith as manager of Penn's Detroit office. An experienced sales engineer, Sanders was formerly manager of the Capitolaire Division of U. S. Radiator Corp. in Detroit and consequently is well-known in the territory. Previously, he was connected with Mayflower Air Conditioners as a factory representative.

E. S. Kyle

E. S. Kyle has been engaged by Penn to manage the company's new branch office which was established on July 15, at 1141 N. Van Buren St., Milwaukee, Wisc. Before joining Penn, Kyle was in the experimental department of Cleaver-Brooks Co., in Milwaukee. In addition to his wide engineering experience, Kyle formerly was engaged in selling electrical equipmnt for 10 years in the Milwaukee area as a manufacturer's agent.

Wausau Appoints Southwest Sales Manager

THE Wausau Motor Parts Company has announced the appointment of M. T. Hulon as Divisional Sales Manager for its Southwest Division.

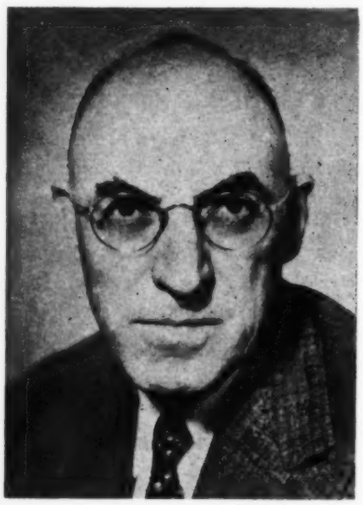
M. T. Hulon

Mr. Hulon will supervise the Wausau Motor Parts Co. sales force in the states of Texas, Oklahoma, Louisiana and Arkansas. The warehouse and offices will be located at 1012 Monroe Street, Fort Worth, Texas. These larger

facilities have been acquired to accommodate the housing of a more complete factory stock and facilitate service to the territory.

James L. Ray Named Turbine Department Head at Hendy

APPOINTMENT of James L. Ray, widely known steam and gas-turbine engineer, is announced by George F. Gayer, chief engineer of the Joshua Hendy Iron Works, Sunnyvale, Calif. Ray will head the company's gas and steam-turbine engineering department in San Francisco and supervise the considerable enlargement of its technical staff.



James L. Ray

Ray was formerly chief gas-turbine design engineer of the Allis-Chalmers Manufacturing Company, where he also served for four years as marine engineer. His career included 11 years with the Westinghouse Electric Corporation, for whom he had charge of steam-turbine blade design; a period with Fairbanks, Morse & Company in Diesel design and development; a year with the Murray Iron Works as general engineer; and several months in England studying gas turbines. The addition of Ray to the engineering staff will be of value to Hendy in steam and combustion-turbine development work now in progress, and in the activation of scheduled manufacturing programs for the future.

Loengard Heads United Chromium

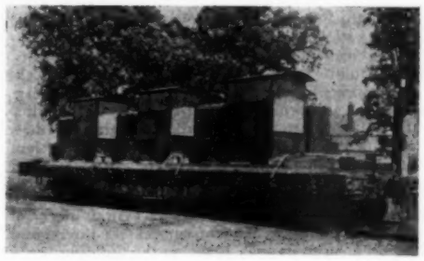
ANNOUNCEMENT is made of the appointment of Richard O. Loengard as President of United Chromium, Incorporated and Theodore G. Coyle and Hugh D. McLeese as Vice Presidents. All three men, well known in the electroplating and metal finishing field, have been associated with the company since its inception. Messrs. Coyle and McLeese will continue

as Technical Director and General Sales Manager, respectively.

Richard O. Loengard

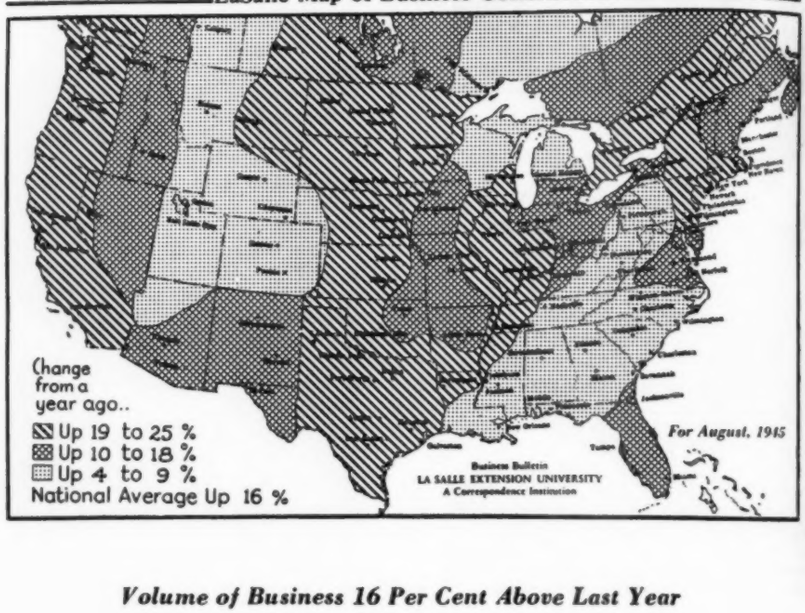
The opening of district offices by United Chromium in Chicago and Dayton has recently been announced and plans are being made for a new office on the Pacific Coast. In addition to the laboratories and offices maintained at Detroit, Mich., and Waterbury, Conn., a new plant is now being equipped at Carteret, N. J., for the manufacture and development of the company's products.

Whitcomb Diesel Locomotives For Holland



For rebuilding dikes in the Netherlands, Whitcomb Locomotive Company, a subsidiary of Baldwin Locomotive Works, is supplying a number of Diesel, 5-ton mechanical drive locomotives to the Netherlands Purchasing Commission, through Lindeteves, Inc. Pictured here is a flat car loaded with six of these locomotives, all powered with Caterpillar Diesels, processed for export and ready for shipment. The original order covered 25 of these units.

LaSalle Map of Business Conditions



Volume of Business 16 Per Cent Above Last Year

Map Supplied by BUSINESS BULLETIN DIVISION of La Salle

The rate of total business activity rose last month in spite of a declining tendency in the amount of factory output. In only a few places have there been any significant signs of summer slackening, as our economic system is kept geared to the large demands of war and civilian consumers with much greater-than-average incomes. The volume of business as measured by financial transactions is 16 per cent higher than it was a year ago, with the most striking increases in the amounts of goods sold to consumers.

The LaSalle Map this month shows several changes which may indicate some of the shifts which are expected to become more prominent during the next few months. One is the continued shift to the West and some slackening in the East. Another is the good showing made throughout the agricultural regions of the Middle West, for farm income remains high and prospects for most crops are favorable. The lag in the East will probably continue for several months until a larger percentage of the industries in that section of the country can complete the reconversion to civilian production

Business in the New England states reflects this reconversion problem more clearly than it does in most other places. Armament cutbacks in the region have been large in such items as shipbuilding, ordnance, and aircraft although the military demand for textiles and shoes remains large. Later in the fall as more materials and labor become available considerable expansion may take place.

The most striking area of very good business is New York City and, to a lesser extent, the region around the city. The large volume of shipments abroad as well as expenditures in connection with the movements of troops from Europe have helped maintain business considerably above the national average. Farm income in the state has also increased more than it has in other parts of the country. These factors will be predominant for several months, but some slackening from the present higher rate is likely later in the year

Production in the industrial region around the Great Lakes is still large but in many places is slowing down somewhat. In the Detroit area employment has dropped somewhat due to reduction in war contracts and, to some extent, because of labor difficulties. The declines will not be extensive, however, because the automobile industry is preparing to speed up the production of cars as soon as it completes war contracts, and when ever materials are available. Conditions are somewhat similar in other places through the central industrial region.

In the Southeast business is lagging quite a little behind the national average, for the cutbacks in military orders there has been somewhat larger than in most other places. Although war production will continue everywhere as long as it is needed, a considerable part of it is being shifted westward nearer to the places where the material and equipment will be used. In other parts of the South, especially in Texas, and Oklahoma, business is holding up very well. Growing conditions for the cotton crop and for other agricultural products have been quite favorable. The winter wheat crop was unusually good and prices have been higher than last year.

In the Pacific Coast states business continues to be excellent. The slowing down in shipbuilding and in some types of aircraft have been more than offset by increases in other lines and by the large movements of troops through the ports. Activity in connection with the war will be the major determining factor in affecting business trends.

The business situation in Canada has changed but little in recent weeks but the trend in many places is gradually downward. The best showing is being made in the industrial region north of the Great Lakes but a high level of activity is also maintained in the agricultural sections. The outlook is for a continuation of about the same trends throughout the next few months.

WEST COAST DIESEL NEWS

By JIM MEDFORD

THE Victoria, B. C., Tug Boat Company's 80-ft. towboat *Strath* is repowered with new 525 hp. Enterprise direct-reversible Diesel increasing her towing power by over 80%.

BUILT by the Harold Hansen Boat Co., Seattle, Washington, the 70-ft. *Bergen II* is powered with a 155 hp. Atlas Imperial Diesel. Owned by Scrapness & Johnson Bros., she will fish north.

THE Commercial Iron Works, Portland, Oregon, has completed several LCS(L) series landing craft for the Navy. 180 ft. long, they are powered with two sets of four 225 hp. Diesel quads by General Motors, Detroit Diesel Engine Division.

GENERAL Motors Diesels are also being used at Newport Harbor, California, by Lowman Boat Works to power a 56-ft., 75-passenger sport-fisherman for Eckert & Huber of Santa Monica.

THE Pacific T. and T. Co., San Francisco, California, has repowered its tug *Telco I* with a 125 hp. Caterpillar marine Diesel with Maxim silencer, Twin Disc gears and Goodrich Cutless stern bearing.

BUILT by the San Pedro Boat Works, San Pedro, California, the 45-ft. combination fish boat *Felicia* for Matteo LeGrande is powered with a 60 hp. Caterpillar marine Diesel by Shephard Diesel Marine Co.

IT'S a 140 hp. Cummins marine Diesel that's being installed in the new 67-ft. Monterey seiner building at Colberg's yard, Stockton, California.

CORRECTION—Ten water taxis built by Anderson & Christofani, San Francisco, California, for S. F. Water Tours Co., are powered with 275 hp. supercharged Hercules Diesels instead of Unions as previously reported in this column. Reduction gears are by Morse and batteries by Exide.

BUILT for Reilly & Gibbons by the A. C. Benson Shipyard Ltd., Vancouver, B. C., a 48-ft. fish boat (unnamed) is powered with a Caterpillar 70 hp. marine Diesel.

GENERAL Motors Diesel distributor Evans Engine & Equipment Co., Seattle, Washington, report installations of these Diesels in the troller *Tyne;* fishboats *Sea Ranger, Banner, Aldona* and *Sunset,* all re-power jobs.

TEN Navy motor sailers have been constructed by Colberg Boat Works, Stockton, California. These 42-ft. boats are powered with 40 hp. Buda Diesels for 8½ knots; fuel pumps are Worthington's.

FOR the Netherlands East India government, the Albina Engine & Machine Works, Portland, Oregon, will build several 180-ft. cargo carriers with 250 hp. at 275 rpm. Enterprise Diesels. Auxiliaries will be two 75 hp. Venn-Severin Diesels turning Burke generators; also two 15 hp. Lister Diesels.

VAGABOND, 86-ft. seiner for Monterey owners, has been completed by the Puget Sound Boatbuilding Co., Tacoma, Washington. Engines are: main, 400 hp. Enterprise Diesel; 60 hp. Caterpillar Diesel auxiliary. Pumps are Fairbanks-Morse; batteries Willard.

OF all-steel construction by National Iron Works, San Diego, California, the 52-ft. fishboat *Juana* is powered with Gray marine Diesels —main engine 165 hp., a 40 hp. engine for auxiliaries.

DOING 9½ knots on her trial run, the 86-ft. power-scow *Robert S* built by Maritime yards, Seattle, Washington, is propelled by a pair of 150 hp. Murphy Diesels.

THE rebuilt former tug *Brookfield* recently converted to a fishboat by the Columbia River Packers Association has been repowered with a 135 hp. supercharged Cummins marine Diesel with Twin Disc reduction gear.

HAILING from Humbolt Bay, California, the tug *Quidnat* is repowered with a 110 hp. Buda marine Diesel with Twin Disc gears by Coggeshall of Eureka, California.

FRAMING is progressing on the new 125-ft. tuna clipper for San Diego interests at United Concrete Pipe Co., Long Beach, California. She will have all Atlas Imperial Diesels—600 hp. main and two auxiliary, one 120 hp. and one 200 hp.

AN 82 hp. Gray marine Diesel has been installed in the work boat *Associated* of the Associated Oil Co., San Francisco, California, by George Kneass yard. Reduction gears are Twin Disc, and sale was made by Thompson Machine Works, distributors.

THE purse seiner *Sea Spray* has just established an enviable record of nine days total time for the 1800 mile round trip from San Diego around Lower California and up the Gulf of California. A 93 ton load of tuna (plus approximately 77 tons of ice) was brought back at a speed averaging better than ten knots, even though the seiner bucked a stiff Northwestern wind off the Lower California Coast and all the way into San Diego. This is one of the fastest times ever recorded for the run and was made during the *Sea Spray's* recent headquartering at San Diego during the last four months.

Charles Dragicevich, one of the owners and chief engineer of the *Sea Spray* reports the record run was due largely to the Enterprise direct-reversible six-cylinder Diesel engine that provides all the power, both propulsion and auxiliary. In commenting on the performance of the Enterprise engine, Dragicevich stated, "This Enterprise Diesel has 4000 hours to her credit and I've never laid a wrench on her. If there's a better engine anywhere, I've never heard about it."

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